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CONTENTS

For complete table of contents see advertising page V

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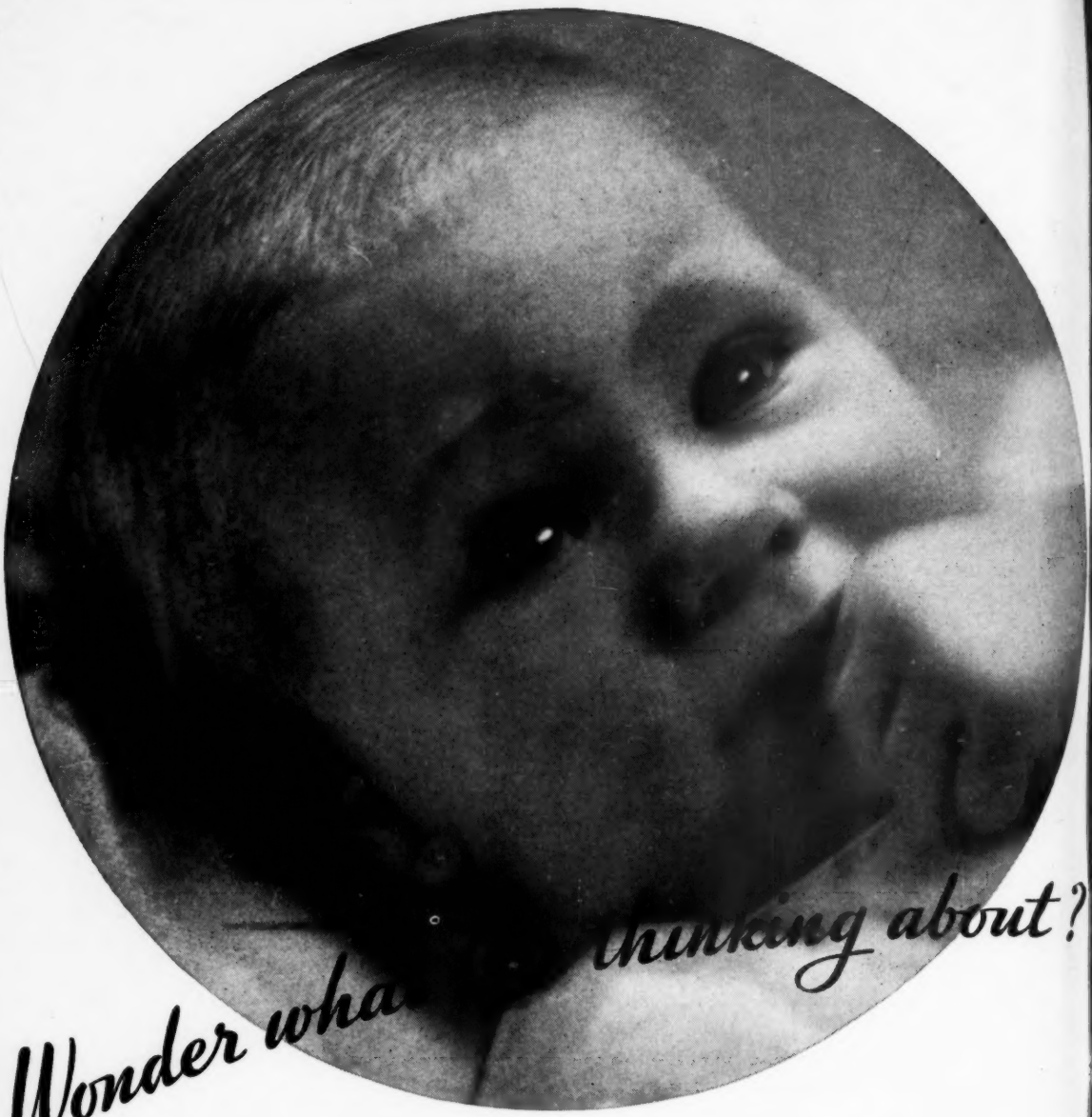

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 18 DECEMBER, 1935 NUMBER 12

THE RELATION OF VITAMIN A TO ANOPHTHALMOS IN PIGS

FRED HALE, M.S.
COLLEGE STATION, TEXAS

Forty-two pigs (four litters) were born blind at the Texas Agricultural Experiment Station in the course of experiments relating to maternal vitamin-A deficiency. Other defects noted were cleft palate, cleft lip, accessory ears, and arrested ascension of the kidneys. Definite and complete genetic tests were made to determine whether or not an hereditary factor was responsible for the eye anomaly and close matings such as blind brother x blind sister, and normal mother x blind son, produced only normal pigs. These studies leave no reasonable doubt that maternal deficiency of vitamin A will result in a variety of defects in the offspring, including blindness and even a failure of complete development of eye tissue, together with those above-mentioned.

The normal mothers of these blind pigs were depleted to a very low state of vitamin A before breeding and were continued on the vitamin-A-free ration for the first 30 days of the gestation period (the time during which the eye develops in the pig embryo).

Vitamin-A deficiency is by no means uncommon in human diet and it may easily be that many of the eye weaknesses which we suffer today are due to maternal vitamin-A deficiency, just as Dr. H. M. Taylor has recently discovered that some of the deafness among Southern children is due to quinine taken by the mother during pregnancy. In any case, it is obvious that until we have evidence to the contrary, we should insist on an abundance of vitamin A in the diet of the expectant mother in the early stages of pregnancy when so many of the vital organs of the embryo are being formed. From the Division of Swine Husbandry, Texas Agricultural Experiment Station. Read before the Association for Research in Ophthalmology, Atlantic City, June 11, 1935.

Numerous publications have appeared relative to the effect of vitamin A on the health of the individual from birth to maturity, and also relative to the health of mature animals and human beings. Osborne and Mendel showed as early as 1913 that if vitamin A is withheld from the ration or diet, the subject will eventually contract a disease of the eye, variously known as ophthalmia, xerophthalmia, keratomalacia, conjunctivitis, or keratoconjunctivitis. It has been shown also that the nerves of animals degenerate when the ration is without vitamin A, but the literature is lacking concerning the relation of maternal vitamin-A deficiency to embryonic development.

In connection with an investigation on the effects of vitamin A on swine, at the Texas Agricultural Experiment Station, a gilt of the Duroc breed that had been fed a vitamin-A-free ration for a period of 160 days before breeding, and for the first 30 days after breeding, farrowed in 1932, a litter of eleven pigs, all of which were born without eyeballs, so far as could be determined by macroscopic examination.

Since anomalies of this nature had not previously been observed in this particular herd in the many years that it has been under observation, and since the ration fed to this gilt was deficient in vitamin A, the natural inference must be that the eye anomaly of the young pigs was in some way associated with maternal vitamin-A deficiency. Further experiments were immediately initiated to determine the relation between vitamin A and embryonic eye development.

Two gilts were placed on a vitamin-A-free ration in an attempt to duplicate this anomaly. At the same time, two other gilts were fed the vitamin-A-free ration, plus one percent of cod-liver oil. These two latter gilts were bred 154 days after they were started on test, and farrowed normal litters in March, 1933. One of the gilts fed on the vitamin-A-free ration failed to show the symptoms of estrus, while the other one was bred 160 days after she was

Fig. 1 (Hale). Showing pig without eyeballs, farrowed June 8, 1934, out of Dam No. 336. Note subcutaneous cysts on head and back.

Fig. 2 (Hale). Showing pig with double cleft lip, farrowed June 8, 1934, out of Dam No. 336. This pig was also born without eyeballs.

Fig. 3 (Hale). Showing pig with extra ear-like growths, farrowed May 11, 1935, out of Dam No. 49. This pig was also born without eyeballs.

Fig. 4 (Hale). Showing pig born with cleft palate, farrowed May 11, 1935, out of Dam No. 49. This pig was also born without eyeballs.

started on the vitamin-A-free ration, but failed to farrow at the end of the normal gestation period. A post-mortem examination by Schmidt indicated the litter had probably perished at an early stage, followed by complete resorption of the fetuses.

In 1933, two additional five-months-old gilts, weighing 102 and 116 pounds respectively, were placed on the vitamin-A-free ration. The gilts were self-fed in a dry lot, and had access to sunshine. On the 176th day after starting on feed, one of the gilts was so completely affected by the depletion of vitamin A that she was unable to get up. A two-ounce dose of cod-liver oil was administered, and she regained her strength so rapidly that she was able to walk within eight hours following the cod-liver-oil treatment. Both gilts were bred to a sire of the Duroc breed on the 190th day after starting on feed. It will be recalled that the litter with the eye defects farrowed in 1932 was sired by an Essex male, which is an altogether different breed. Symptoms of vitamin-A deficiency in the gilts at the time of breeding were evidenced by their wobbly gait, weaving, and crossing of the hind legs at the walk, drooping of the ears, and loss of weight. After the gilts were bred, they remained on the vitamin-A-free ration for the first 30 days of the gestation period, the time during which it is known that the eye develops in the pig embryo. After the first 30 days of the gestation period had passed, the gilts were given an abundance of vitamin A in the form of cod-liver oil, so as to furnish them every opportunity to complete a full gestation period.

On June 8, 1934, both gilts farrowed. The gilt that had gone through the entire 190 day period without vitamin A farrowed a litter of ten pigs. A macroscopic examination showed that all these pigs were born without eyeballs, an exact duplicate of the litter produced under similar conditions in 1932. The gilt that had received a single dose of cod-liver oil two weeks before conception, farrowed fourteen pigs. In this litter, macroscopic examination showed various combinations of eye defects; some with no eyes; some with one eye; some with one large and one small eye; but all were blind. Three pigs of this litter, all blind, were raised to maturity on a normal ration. In both litters, various other defects were also observed, such as accessory ears, subcutaneous cysts, hare lip, and misplaced kidneys.

Fig. 5 (Hale). Showing normal eye of pig (A), and a pair of defective eyes (B). The anomaly was from a pig farrowed June 8, 1934, out of Dam No. 187. Both the normal eye and the pair of blind eyes were removed from ten-months-old pigs.

Finally, on July 6, 1934, another five-months-old gilt weighing 106 pounds was placed on the vitamin-A-free ration, and fed under the same conditions as those previously described. She was bred 192 days after starting on test, to a Duroc male unrelated to any other sire used in these tests, and on May 11, 1935, she farrowed seven pigs, all without eyeballs, as determined macroscopically. Other defects observed in the pigs were: hare lip, cleft palate, accessory earlike growths at the base of the ear, malformed hind legs, and a failure of the kidneys to ascend from their embryonic position.

It might be assumed that the eye anomalies here described are due to heredity; that the genetic factors responsible for them are existent in our herd and have appeared only when certain matings were made. The evidence against hereditary transmission is almost overwhelming, and may be briefly set forth as follows: (1) No other blind pigs have been farrowed in our herd since this herd was established twenty

years ago. (2) The three sires and the four dams of the forty-two defective pigs had apparently normal vision. (3) The three sires have produced only normal pigs when bred to other sows. (4) were from gilts unrelated to the gilt that farrowed the eyeless pigs in 1932, and their sire was of a different breed. (6) The only eyeless pigs produced in our herd have been from sows that were

Table 1

DATA PERTAINING TO THE PRODUCTION OF BLIND PIGS FROM NORMAL SOWS FED RATIONS DEFICIENT IN VITAMIN A

Dam No.	Sire Breed-No.	Date Litter of Pigs Farrowed	No. of Pigs in Litter	No. of Pigs Born Blind	No. of Normal Pigs	Kind of Ration Fed Dam of Litter	Other Defects in Litter of Pigs
38	Essex-2	3–29–32	11	11	None	Vitamin-A deficient**	Misplaced kidneys in 2 pigs
38	Duroc-3	8–19–32	4	None	4	Vitamin-A deficient plus green pasture	None
114	Duroc-5	3–20–33	8	None	8	Vitamin-A deficient plus 1% cod-liver oil	None
20	Duroc-5	3–27–33	9	None	9	Vitamin-A deficient plus 1% cod-liver oil	None
336	Duroc-14	6– 8–34	10	10	None	Vitamin-A deficient**	Subcutaneous cysts, cleft palates hare lip, misplaced kidneys, extra ear-like growths
187	Duroc-14	6– 8–34	14	14	None	Vitamin-A deficient**	Misplaced kidneys
336	Duroc-45	12–17–34	10	None	10	Vitamin-A deficient plus green pasture	None
187	Duroc-45	12–20–34	11	None	11	Vitamin-A deficient plus green pasture	None
49	Duroc-1	5–11–35	7	7	None	Vitamin-A deficient**	Harelip, cleft palates, misplaced kidneys, extra ear-like growth
46	Blind boar son of sow 187	5–11–35	11	None	11	Vitamin-A deficient plus green pasture	None
187	Blind boar son of sow 187	5–19–35	8	None	8	Vitamin-A deficient plus green pasture	None
12*	Blind boar son of sow 187	5–26–35	7	None	7	Vitamin-A deficient plus green pasture	None

* Blind gilt out of sow 187.
** Dam started on cod-liver oil on 30th day of gestation period.

The 1932 eyeless condition was duplicated exactly in 1934 and again in 1935, but only in connection with vitamin-A-free rations. (5) The two litters of defective pigs farrowed in June, 1934, practically depleted of vitamin A at the time of conception. (7) Definite and complete genetic tests were made in order to determine whether or not we were working with an hereditary

anomaly already in the stock of pigs we were using. These tests included the mating of the blind male from one of the 1934 litters of blind pigs (a) to a normal, unrelated gilt, (b) mating the blind male back to his dam, (c) mating the blind male to his blind full sister and litter-mate. From these three matings, 26 normal pigs and no abnormal pigs were farrowed.

As a matter of fact, it will be obvious to any one familiar with the principles of heredity, that there are only two hereditary mechanisms by which normal parents could produce blind offspring. The first possibility assumes that both parents were heterozygous for recessive factors responsible for blindness, in which case one fourth of the offspring on the average would be expected to be blind, just as in humans two brown-eyed parents may have some blue-eyed children. This possibility is ruled out by the first litter of eleven blind pigs, even without additional evidence that has since accumulated. There is only one chance in about four million of all the offspring in a litter of this size being recessive, an event, for all practical purposes, not so much more common than an all-trump hand in bridge, or the birth of human quintuplets. The second possibility is that the two normal parents carried complementary factors which when combined in the offspring produced these various eye and other defects in the same way that the crossing of two white-flowered sweet peas sometimes produces purple flowers in the first generation. Such a situation could easily result in blindness in all of the offspring, but this hypothesis is ruled out because the blind pigs themselves have completely failed to transmit their blindness to their offspring, even in very close matings, such as brother and sister and mother and son (see table 1).

These studies leave no reasonable doubt that a maternal deficiency of vitamin A will result in a variety of defects in the offspring, including blindness and even a failure of complete development of eye tissues, cleft palates, hare lip, and the arrested ascension of the embryo kidney. The question at once arises as to the relation of these results to various eye defects and weaknesses in the human race. It may be argued that there is a vast gap between pigs and people, but from the biological and nutritional standpoint, the differences are not so great as might appear at first glance. Both are omnivorous mammals with a relatively long gestation period.

It must not be forgotten, of course, that the nutritional conditions which brought about our litters of blind pigs are extreme and exaggerated. It would be almost impossible for an expectant mother to be as nearly depleted of vitamin A as were the animals in our experiments. On the other hand, vitamin-A deficiency is by no means uncommon in human diet—especially where the variety of food is limited. Furthermore, the instance of the one gilt that received a single dose of cod-liver oil two weeks before conception, and subsequently gave birth to pigs with eyes, but with a variety of defects including blindness, points to the fact that there are various degrees in which a lack or deficiency of vitamin A can affect eye development. Just as Dr. H. M. Taylor has recently discovered that some of the deafness among Southern children is due to quinine taken by the mother during pregnancy, so it may easily be that many of the eye weaknesses which we suffer today, are due to maternal vitamin-A deficiency. Perhaps we have been forcing our spinach on the wrong victims; it ought to be administered to the mothers instead of the children. In any case, it is obvious that until we have evidence to the contrary, we should insist on an abundance of vitamin A in the diet of the expectant mother in the early stages of pregnancy when so many of the vital organs of the embryo are being formed.

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Discussion. DR. WALTER B. LANCASTER: I should like to ask if any investigation was made to see whether blindness in humans is connected with a deficiency in vitamin A.

MR. HALE: You mean in the literature. There is nothing in the literature that I could find that would indicate that any observations have been made and conclusions drawn to that effect, but, on the contrary, there is nothing to show it was not. I do not think the subject has been studied from the naternal vitamin-A-deficiency standpoint. Most of what I was able to find relates from the date of birth instead of previous to birth.

DR. A. M. YUDKIN: I should like to state that anophthalmos, microphthalmos, and macrophthalmos, unilateral and bilateral, were observed in our rat colony previous to 1927. These ocular malformations were not found in subsequent litters of the same combination of parents when subjected to a similar environment and fed the same type of diet. The rations were adequate in maintaining normal growth and good health.

A similar observation was made in another well-known rat colony in this country. It is not unusual to find ocular deformities in other laboratory animals, particularly in the rabbit.

If sterility is associated with a vitamin-A deficiency, would you expect to have specimens for examination? Even though the diet may be lacking in vitamin A, would you not find other types of ectodermal disturbance?

I should like to see further observation made in his and other agricultural stations on pigs before concluding that the ocular changes are directly due to vitamin-A deficiency.

MR. HALE: In the four gilts I showed you in the graph we had a complete setup, two gilts receiving vitamin-A-deficient rations, the other two receiving the same rations plus one percent of cod-liver oil. Only the gilts receiving the cod-liver oil that furnished the vitamin A had perfectly normal pigs. We have duplicated the condition we observed in 1932, three different times with unrelated animals and have taken these animals and have proved to the geneticist and to anyone familiar with heredity that the eye anomaly was not due to heredity.

We have taken these deficiency rations and added cod-liver oil and have never been able to get these defects on such rations. We have produced forty-two blind pigs with these vitamin-A-deficient rations. We have produced these defective pigs by using two points

of technique that are of paramount importance. First, the mother must be depleted to a very low state in vitamin A before breeding. Second, the vitamin-A-deficient ration must be continued after the animal is bred until the stage of embryonic eye development has passed, and there is nothing in the literature that I can find to show that such tests have been made other than what I have read here today according to our method of procedure.

DR. FREDERICK H. VERHOEFF: I should like to ask if it ever failed when you tried to do that?

MR. HALE: Yes, it has, but it is hard to tell when these animals are depleted to the state where vitamin A is practically depleted out of the body. You have to observe that yourself and be enough of an animal husbandman to know the symptoms exhibited by those pigs with vitamin-A deficiency. I doubt if anyone who is not familiar with pigs showing vitamin-A deficiency could ever succeed, except through trial and error for a good many periods.

We succeeded the very first effort we made, after we selected young gilts the same age and weight of the first gilt. When we failed, it was with mature animals. We thought the one-hundred-and-sixty-day period on which we kept the first gilt was of some significance, but found it is not of any significance. The important feature is to deplete the animal to a very low state in vitamin A. We kept mature animals on a deficient ration for one hundred and sixty days and failed, but never have failed when we withheld breeding until the animals showed depletion, by these vitamin-A symptoms, to a very low state.

DR. THOMAS B. HOLLOWAY: I should like to know whether sufficient time has elapsed to determine whether these blind pigs represented a true case of anophthalmos or simply instances of excessive microphthalmos. In one slide shown the optic nerves entered the orbits.

MR. HALE: It is not a true anophthalmos. Only by microscopic examination would you know there was no anophthalmos. We have not gone very far with microscopic work yet.

DR. C. W. RUTHERFORD: What effects of these experiments were noted on the orbits and the extraocular muscles?

MR. HALE: We have not made those observations yet. We have these animals, however, in formalin, and we intend to make very extensive studies along that line.

DR. EDWARD JACKSON: Would it not be a fair supplementary experiment to subject an entirely different species and different family of animals, rats, to a similar vitamin-A-deficiency diet and see what the effect would be on them? Would that be in the same line of experiment?

MR. HALE: These experiments are only four years old and are so new that they are just in their infancy. There are so many angles to the question that studies will have to proceed for several years before we can get at this problem from all angles.

But if we should use rats (we are using rats now) and fail, you might ask yourself the question—Will we say the lack of vitamin C does not cause scurvy because we cannot give scurvy to a rat?

DR. LANCASTER: Has it been tried in poultry?

MR. HALE: No, not in poultry.

STREPTOCOCCAL PSEUDOMEMBRANOUS CONJUNCTIVITIS

Report of a Case

H. C. KLUEVER, M.D.
IOWA CITY

The etiologic agent in a case of streptococcal pseudomembranous conjunctivitis which occurred in a girl 6 years old was investigated over a period of 30 months. In the left eye, an extensive involvement of the cornea did not respond to ordinary treatment and after a few months the eye was enucleated. Later the right eye was attacked and there also developed a pseudomembranous vaginitis and acute glomerular nephritis.

Various organisms were isolated from the bacterial flora of vagina and conjunctiva, but Streptococcus haemolyticus alone reproduced the symptoms in laboratory animals. At each exacerbation of the disease this organism appeared in cultures, then disappeared after a short time, although the pseudomembranes continued to form, leading to the conviction that the organism persisted dormant subconjunctivally.

Lesions of the right eye and vagina responded favorably to treatment with scarlet-fever streptococcal antitoxin and apparently healed after immunization with scarlet-fever toxin and autogenous vaccine, although a granuloma persisted in the left socket over the entire period of 30 months.

Extensive studies into the nature of the organism were made as well as pathologic investigations of sections of the pseudomembranes and the enucleated eye.

From the Department of Ophthalmology, College of Medicine, State University of Iowa. Read before the Association for Research in Ophthalmology, Atlantic City, June 11, 1935.

The etiology of pseudomembranous conjunctivitis, except in cases due to trauma, caustics, or infection with Corynebacterium diphtheriae, Neisseria gonorrhoeae, or Hemophilus conjunctivitidis, remains obscure despite extensive studies. Fuchs[1], in 1876, observed streptococcus in a conjunctival pseudomembrane; since then it has been found by Fage[2], Terson[3], Guibert[4], Pichler[5], Van der Straeten[6], Howe[7], Meyer[8], Kauffmann[9], Aubineau (reported by Morax)[10], Valude[11], Hanke[12], Derby[13], Kimpel[14], Jessop[15] Amsler[16], Hegner[17], Hartlev[18], Raffin[19], Schuster[20], Vancea[21], Kalt and Autier[22], Zimmermann[23], Rutherford[24], Borel[25], Croci[26], and others. This organism has been recognized as a cause of pseudomembranous conjunctivitis by Morax[27], Roemer[28], von Hoor[29], Parsons[30], Uhthoff[31], Knapp and Rössle[32], Soudakoff[33], Axenfeld[34], and Coppez[35], but the evidence upon which recognition was based is incomplete.

Marmorek[36], in 1895, prepared an antistreptococcal serum which was used in the treatment of pseudomembranous conjunctivitis with beneficial results by Kalt[37] and Aubineau[10]. Roemer[28] states: "In all serious streptococcal inflammations of the eye recourse should be taken immediately to the specific streptococcus serum. The longer my experience with this serum the stronger my conviction becomes that it cannot be denied an action comparable with those of other serums. Many times it has proved itself able to save not only the eye, but the life of a child suffering from a grave streptococcal infection, and it must therefore not be left untried." Parsons[30] and Axenfeld[34] are in accord with Roemer.

Conjunctival pseudomembranes may persist for months or years. Morton[38] reported a pseudomembrane which persisted for 8 years, Guibert[4] one which lasted 7 years, and Harlan[39] saw one that had persisted for 6 years. Moore[40], who saw two cases of 6 and 8 years duration, respectively, states: "Some of these cases are perhaps caused by the streptococcus and it may be that all are due to this organism."

Morax[27] states that conjunctival pseudomembranes occur most frequently as a complication of some general disease. Pseudomembranous conjunctivitis from which streptococci were isolated has been reported as a complication of erythema multiforme by Raffin[19], Hanke[12], and Hartlev[18]; Barkan[41] reported a similar case but bacteriological studies were omitted. Manz[42] observed a child with a "wet eruption" of the skin of the face which was followed by pseudomembranous

conjunctivitis and erysipelas; bacteriological studies were not included. Bailey[43] observed a case of erythema multiforme with a conjunctival pseudomembrane from which hemolytic staphylococci were isolated. Stevens and Johnson[44] and Wheeler[45] isolated streptococci from the conjunctivae in purulent ophthalmia accompanied by an eruptive fever with stomatitis. Scarlet fever occurred during the course of pseudomembranous conjunctivitis according to Hutchinson[46] and Mason[47], while in Pritchard's[48] case the formation of a pseudomembrane followed recovery from scarlet fever; no bacteriological observations were included in these reports.

Guibert[4] observed a child with a pseudomembranous conjunctivitis which was limited to one eye for seven years, and then involved the second eye after an attack of acute pharyngitis; streptococci were isolated from the conjunctiva. Von Hoor[29] reported an infant with a streptococcal infection of the navel followed by cervical adenitis and bilateral pseudomembranous conjunctivitis; the mother had had a recurrent streptococcal sore throat. Derby[13] observed the formation of conjunctival pseudomembranes following the appearance of a small abscess above the lacrimal sac and in this case Weeks[49] found streptococci in the conjunctiva. The case reported by Rutherford[24] followed an infection of a finger. Howe[7] observed two children, a brother and sister, with pseudomembranous conjunctivitis. The girl had a catarrhal vaginitis with later development of a pseudomembrane and eventually a pseudomembranous conjunctivitis. Streptococci were found in the conjunctiva during the first year; later diphtheritic patches developed in the throat and Corynebacteria diphtheriae were isolated from the conjunctiva. Streptococci, but never Corynebacteria diphtheriae, were isolated from the conjunctiva of the boy.

Only a few of the more recently reported cases of typical nondiphtheritic pseudomembranous conjunctivitis failed to show streptococci at some time during the course of the disease. The case reported by Bailey[43], belongs to the group in which streptococci were not found. A. Knapp[50] isolated what was believed to be influenza bacilli in a case in which the pseudomembranes persisted for approximately one month. Bollack[51] observed pseudomembranes of the conjunctiva which three years later were recognized to be due to actinomycosis. Gerke and Kain[52] isolated bacilli which appeared to be similar to the organism of chicken cholera from a bilateral pseudomembranous conjunctivitis. Morax-Axenfeld bacilli were isolated from a case by zur Nedden[53]. Dominquez and Lutz[54] made bacteriological studies of a gram negative organism which was isolated from an atypical circumscribed pseudomembranous conjunctivitis but the organism was not identified. Dunphy[55] observed a bilateral membranous conjunctivitis with corneal involvement from which King isolated a corynebacterium.

Niccol[56] cites a case of atypical diphtheritic conjunctivitis of five weeks' duration which followed an operation for convergent strabismus. The pseudomembranes disappeared within two days following the administration of 5000 units of diphtheria antitoxin. Taylor[57] observed a similar case.

It is of striking interest to observe that the Nobel prize for the advancement of medicine was established because the founder's daughter was blinded by pseudomembranous conjunctivitis (Borel[25]).

Case Report

During the past 30 months a case* of streptococcal pseudomembranous conjunctivitis, complicated by pseudomembranous vaginitis and acute glomerular nephritis, has been under almost continuous observation in the ophthalmic clinic at the State University of Iowa.

A. B., a girl 6 years of age, was admitted on November 11, 1932. The

* A case report of this observation has been published in The Transactions of the American Ophthalmological Society, 1933, v. 31, p. 237, by Dr. C. W. Rutherford under the title "Membranous conjunctivitis with persistent membranes completely covering the cornea."

family history was irrelevant. As an infant the child had contracted impetigo from which she recovered within a few weeks. When 16 months of age she had had a severe bilateral purulent chronic conjunctivitis of unknown etiology with recurrent pseudomembranes on the palpebral conjunctiva of the left eye. Two years later, following measles, pseudomembranes had been present on the palpebral conjunctiva of the right eye for two or three months. One month prior to admission she had had a sore throat accompanied by a skin eruption described by the mother as "small red places on the back and arms." The sore throat and eruption had disappeared after 4 days but the left eye was painful, the lids swollen, and pseudomembranes had formed on the palpebral conjunctiva; ten days later a pseudomembrane had appeared over the cornea. The right eye was not affected.

On admission the lids of the left eye were moderately swollen and a slight serous discharge was present. The conjunctiva of each lid was covered with a tough grayish-yellow pseudomembrane of a consistence not unlike chamois skin. These were easily removed, leaving behind a bleeding, roughened surface which was almost immediately covered with a new pseudomembrane. A thick unremovable pseudomembrane covered the entire cornea.

General physical examination, including laboratory studies, revealed essentially normal findings.

The conjunctival pseudomembranes were removed daily and many forms of treatment were administered during the next five months; e.g., diphtheria antitoxin, intravenous typhoid vaccine, in-

Fig. 1 (Kluever). Pseudomembrane on right upper eyelid.

Fig. 2 (Kluever). Granuloma on left upper eyelid.

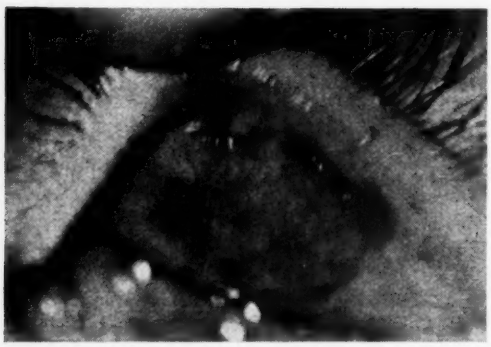

Fig. 3 (Kluever). Left upper eyelid immediately after removal of granuloma.

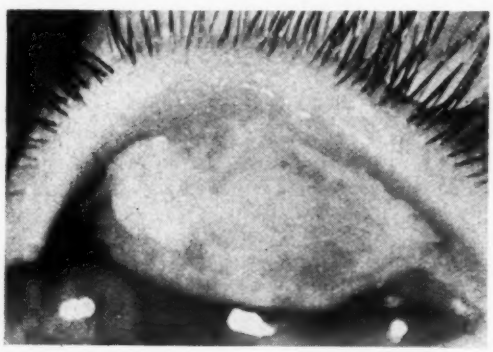

Fig. 4 (Kluever). Pseudomembrane on left upper eyelid 24 hours after removal of granuloma.

tramuscular autogenous streptococcal vaccine, and many local remedies. After a few weeks the conjunctiva of the lower lid appeared to be normal and three months later the pseudomembrane disappeared from the upper lid but at no time was there improvement in the cornea.

Since vision was lost and the only apparent remaining focus of infection was in the cornea, the globe was enucleated on April 25, 1933. Conjunctival pseudomembranes immediately reformed and entirely filled the socket. The right eye remained normal and the child was discharged on June 22, 1933.

Five weeks later the child was admitted to the Children's Hospital with an acute glomerular nephritis. During her absence from the institution she had had an attack of mumps. On admission, in addition to nephritis and persistent pseudomembranes in the left socket, there were a vaginitis and a conjunctival injection of the right eye.

Zinc sulphate solution (0.25 percent) was administered to the right eye and the following morning a definite pseudomembrane was present on the conjunctiva of the upper lid. Argyrol was substituted for the zinc preparation. The pseudomembrane was removed frequently but it reformed quickly and each time over a greater area, until it covered the entire conjunctiva of the upper lid. There was also an acute dacryocystitis with evidence of a pseudomembrane in the superior punctum and canaliculus. Roentgen-ray treatment (600 r. in two doses) was administered to the conjunctiva of the right upper lid and two weeks later 5 milligrams of radium was applied directly for five minutes, but in spite of treatment the condition progressed. The child complained of photophobia, itching, and burning of the right eye; early corneal involvement was apparent and the general condition of the patient was grave.

The serious prognosis demanded heroic therapeutic measures and on September 10, 300,000 units* of scarlet-fever antitoxin was administered subcutaneously. Immediately the pseudomembrane of the right upper eyelid diminished in size and decreased in thickness. Hexylresorcinol 1:4000 and enzymol were instilled into the conjunctival sac every half hour. The enzymol was used in the vain hope that it would dissolve the pseudomembranes.

In late September the pseudomembrane in the punctum and canaliculus disappeared but that covering the conjunctiva of the right upper lid was firmly attached to a mass of granulation tissue and its attempted removal was only partially successful. The mass of gray-red, friable granulations was shaped like a toadstool with a height of 2 mm., a stalk diameter of 3 mm., and a crown diameter of 5 mm. Similar granulomata occurring with pseudomembranous conjunctivitis have been observed by Noyes[58], Morax[59], H. Knapp[60], Dorrell[61], Borel[25], and Morton[38]. Excision of the granuloma and cauterization of its base with either silver nitrate or trichloracetic acid was followed by extension. Cauterization was therefore discontinued, and the granuloma was removed with sharp scissors.

An autogenous vaccine (750 million killed cocci per cubic centimeter) was prepared from the hemolytic streptococci found on the conjunctiva, and on September 23, the first course of 12 *intradermal* injections was started. Injections were made every third day, beginning with 0.1 c.c. and gradually increasing to 1 c.c. Three weeks later the pseudomembrane had almost disappeared from the right eye but an area of granulations 2.5 mm. in diameter persisted. The condition of the left socket had remained unchanged. The vaginal pseudomembranes had entirely disappeared, the edema of the lower extremities was gone, urinalysis showed only a trace of albumin and an occasional red blood cell, and the blood pressure was 110/78 mm. of mercury.

On October 17, she again received

* Since this paper was written, National Institute of Health standard units have replaced the original neutralizing units. The 300,000 units referred to above equal 6,000 U.S.P.H.S. units.

300,000 units of scarlet-fever antitoxin.

The pseudomembranes were removed from the left socket on October 23, and the large underlying granuloma was excised. A small soft rubber tube was laid into the socket and a heavy dressing applied. Fifteen cubic centimeters of filtered autogenous streptococcal-broth vaccine (Besredka[62]) was introduced through the rubber tube every half hour for five days, but was discontinued because of maceration of the skin. The broth vaccine was continued as drops for two additional days. On the seventh day the lids appeared swollen and at least 25 small blebs, varying in diameter from 1 to 3 mm., appeared on the skin of the lids and cheek. The pseudomembrane had reformed over the entire conjunctiva of the socket. The following day these blebs had ruptured and disappeared but three larger blebs, 0.5 to 0.75 cm. in diameter, were present elsewhere on the face, and there was another 1 cm. in diameter on the right thumb. The right eye presented a striking picture; the conjunctivae of both lids had become covered over night with heavy pseudomembranes, 1 to 2 mm. in thickness and the bulbar conjunctiva was injected, but fortunately the cornea remained clear.

At this time scarlet-fever antitoxin was applied locally to the conjunctivae, and on November 18, the second course of 12 intradermal injections of autogenous vaccine was begun. The conjunctival inflammation subsided slowly and the pseudomembranes and granulomata became less and less extensive; by December 3, they had disappeared entirely from the right eye. The granuloma of the left upper lid partially reformed and was covered with a thin pseudomembrane; the vaginal pseudomembrane did not recur.

An acute pharyngitis developed on January 20, 1934, and the left socket was soon filled with pseudomembranes. The conjunctiva of the right eye became injected and the following day thick pseudomembranes were present on both lids. Scarlet-fever antitoxin (300,000 units) was administered, and the pseudomembranes disappeared from the right eye within 24 hours, while those in the left socket were restricted to the upper lid within four days.

One week after the pseudomembranes had disappeared from the right eye an attempt was made to immunize the patient to scarlet-fever streptococcal toxin. The resulting area of redness from 1 S.T.D. (skin-test dose) of scarlet-fever toxin given intradermally was quite faint and measured 10 x 15 mm. Fifty S.T.D. of toxin were given subcutaneously but on the following day the pseudomembrane of the left socket and the injection of the conjunctiva of both eyes increased. The increased discharge from the vagina and the right eye contained many coarse strings of fibrin, and, although a new vaginal pseudomembrane developed, the conjunctiva of the right eye remained clear. The attempted immunization was discontinued and on February 13, a third course of 12 intradermal doses of autogenous vaccine was begun. The conjunctival injection and discharge decreased but the vaginal pseudomembrane persisted.

Immunization to scarlet-fever streptococcal toxin was attempted again on March 3; subcutaneous injections of small amounts of toxin (12, 25, 30, and 50 S.T.D.) were administered every second day. After the fourth injection (50 S.T.D.) a transient pseudomembrane developed over the conjunctiva of the right lower lid, and the pseudomembranes of the left socket and vagina increased in size. The next dose of toxin was decreased to 25 S.T.D. and then each successive dose was increased to approximately twice the amount of each preceding dose; injections were given at five-day intervals. There was a total of 20 injections, the last two containing 80,000 S.T.D. each. Pseudomembranes did not recur in the right eye and they disappeared from the vagina at about the time that the dosage of toxin reached 1000 S.T.D. However, with each injection the pseudomembranes increased temporarily in the left socket.

Immunization with autogenous vaccine was continued for one year. The

strength of the vaccine was increased to 1500 million cocci per cubic centimeter. The right eye and vagina remained normal except for one exacerbation of two days' duration which followed too large a dose of vaccine. The granuloma and pseudomembrane persisting on the left upper eyelid decreased in size until only a third of the conjunctival surface of the lid was involved. Practically no scar formation could be demonstrated on the other lids. The general condition of the patient appeared excellent throughout this period.

Laboratory Studies

Bacteriological

A study of the bacterial flora of the conjunctiva was carried on for 9 months and resulted in the isolation of the following organisms: Streptococcus haemolyticus, Streptococcus viridans, Streptococcus nonhaemolyticus, Staphylococcus pyogenes aureus, Staphylococcus epidermidis albus, Staphylococcus citreus, Diplococcus pneumoniae, Corynebacterium xerosis and other nonpathogenic corynebacteria*. Streptococcus haemolyticus was the only organism of this group with which comparable pseudomembranes were produced experimentally in animals.

During the first few weeks, conjunctival cultures showed intermittently a few colonies of Streptococcus haemolyticus, but fewer and fewer colonies appeared, and after 3 months this organism was no longer found; it had been absent for 4 months when the patient was discharged. During the second period of hospitalization, after the attack of mumps, cultures persistently showed a few colonies of Streptococcus haemolyticus. One month after admission, almost pure cultures of countless colonies of the organism were obtained for several weeks from the conjunctiva and vagina. The streptococcus persisted for 5 months and then disappeared for 10 weeks. Positive conjunctival cultures of the organism were obtained for the last time for 5 weeks following the attack of acute pharyngitis. Blood cultures were always negative.

After Streptococcus haemolyticus had been obtained in great numbers and in practically pure cultures from both the conjunctiva and the vagina, studies were limited to this organism.

Morphology: The organisms were Gram-positive cocci averaging 0.06 mu in diameter and appeared singly, as diplococci, and as chains varying from 3 to 135 organisms. Some were biscuit shaped and others spherical; there were no rod nor clublike types. Involution forms were represented by only a few large cocci 0.68 mu in diameter.

Colony formation: Cultures grown on blood agar for 24 hours at 37° C. showed somewhat grayish, moderately translucent colonies, shaped like truncated cones with rounded, gray, slightly opaque tops; their surfaces were smooth and glistening. The colonies varied from 0.12 to 0.25 mm. in diameter and were elevated to a height estimated to be one fifth of the diameter. Colonies of 72-hour cultures became opaque, granular, and disc-shaped. The horizontal surfaces were perfectly flat; the outer narrow circumferential surfaces, inclined more or less toward the vertical, were slightly grooved with radial ridges and furrows which produced a slight undulation of the free edges. The colonies varied in diameter from 0.33 to 0.75 mm., and in thickness averaged 0.06 mm. Cultures of deep colonies, made by adding streptococci and defibrinated blood to melted plain agar, were biconvex but a few became lobulated after 48 hours of incubation.

Oxygen and temperature requirements: Cultures on blood agar, grown at 37° C., under aerobic and partial and complete anaerobic conditions, showed no variations. Similar aerobic cultures at 20° C. showed a growth of extremely small colonies, visible only with a hand lens, after 72 hours; no visible growth was obtained at 45° C. Exposure to 60° C. for 30 minutes killed the organisms.

Production of hydrogen peroxide and **hydrogen bisulphide:** The production of H_2O_2 (M'Leod and Gordon[63]), as revealed by the presence of a yellowish

* Dr. Irving H. Borts of the Iowa State Hygienic Laboratories found that corynebacteria isolated from the pseudomembranes were entirely avirulent for guinea pigs. Corynebacterium ulcerans was not found.

or greenish discoloration of the areas of hemolysis on blood agar, was never demonstrated; cultures on chocolate agar never produced a greenish discoloration of the media (M'Leod, Gordon and Pyrah[64]).

The **production of H_2S** (Ayres and Johnson[65]) could not be demonstrated with 72-hour cultures in double strength slightly alkaline peptone broth, but when sodium thiosulphate (0.25 per cent) was added H_2S was produced within 24 hours.

Sugar fermentations: Because of the confusion concerning sugar fermentations by streptococci (William[66]), the procedure followed in these studies is given in detail. The culture medium was made of 300 c.c. of ascitic fluid, 300 c.c. of meat infusion broth, 400 c.c. of water, 10 gm. of the respective sugar and sufficient litmus; it was adjusted to a pH of 7.5, tubed, and autoclaved. Each tube of sugar medium was inoculated with an equal amount of a suspension of the organism and the purity of the culture was confirmed at 24, 48, and 72 hours, respectively. The reactions were read at 72 hours. No gas was formed by any sugar; fermentation occurred with dextrin, levulose, salicin, saccharose, lactose, dextrose, mannite, galactose, and maltose but not with xylose, raffinose, inulin, or dulcite.

Final hydrogen-ion concentration: Avery and Cullen[67] observed a constant difference in the final hydrogen-ion concentration of hemolytic streptococci from bovine sources and those from human sources. They found that most human strains had a final pH of from pH 5.0 to pH 5.3 while strains from bovine sources had a final pH of from pH 4.3 to pH 4.5.

The streptococcus isolated from the pseudomembrane had a final hydrogen-ion concentration of pH 5.0, which corresponds to the pH of human strains.

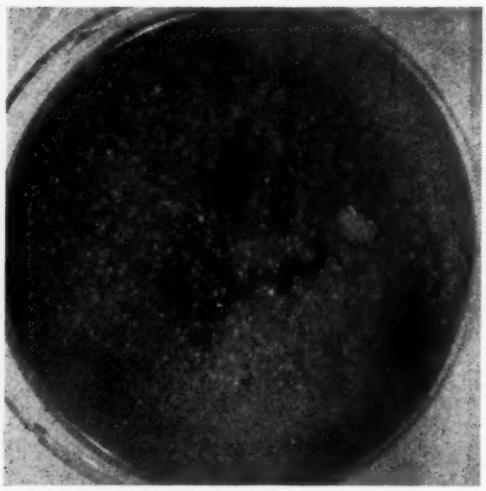

Fig. 5 (Kluever). Conjunctival cultures on blood agar showing almost pure growth of Streptococcus haemolyticus.

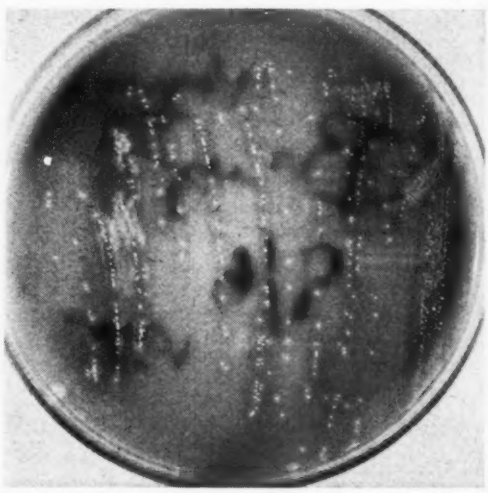

Fig. 6 (Kluever). Vaginal culture on blood agar showing almost pure growth of Streptococcus haemolyticus.

Reduction of nitrates to nitrites and **liquefaction of gelatin and Loeffler's serum:** Nitrates were not reduced to nitrites when the streptococcus was grown in nitrate broth after the method of Ford[68].

Only a feeble growth was obtained on gelatin or Loeffler's blood serum and neither was liquefied.

Studies of the opsonic index: A comparison was made between the percentages of phagocytosis with serum taken from the patient before autogenous vaccine was administered and that taken after this treatment was instituted; the procedure advised by Tunnicliff[69] was used in these studies. The percentage of polymorphonuclear cells taking part in

the phagocytosis before the treatment averaged 1 percent (opsonic index, 0.03) and afterward 68 percent (opsonic index, 2.1). Controls carried out on the sera of a number of healthy individuals averaged 32 percent.

The production of streptolysin: The beta type of hemolysis, in colonies on blood agar plates, was complete in the immediate proximity of the colonies; in the outer margins of the hemolytic areas, which averaged 0.50 and 2.50 mm. in diameter for 24- and 72-hour cultures, respectively, a gradually increasing number of unhemolized red blood cells appeared until finally all of the cells remained unaffected. The hemolysis was clear and without the greenish discoloration characteristic of the alpha type. When 24-hour cultures on blood-agar plates were placed in the ice box for 24 hours and again incubated at 37° C. for 24 hours, hemolytic ring formations characteristic of alpha prime hemolysis were never produced. The hemolysis produced by deep colonies in blood-agar plates was of the beta type.

Over a period of six months repeated attempts were made to produce a streptolysin. The media advised by Todd[70] and by Swift and Hodge[71] were heavily inoculated and incubated for 18 hours, after which they were filtered through a Berkefeld "V" filter. The filtrate was reduced under a negative pressure of 64 mm. of mercury by the addition of one gram of sodium hydrosulphite per 1000 c.c. of filtrate and transferred for storage in vaseline-sealed tubes. With this procedure streptolysin of considerable strength was produced easily when a streptococcus was used which had been isolated from the conjunctival sac of a man who had had recurrent attacks of erysipelas accompanied by an acute keratoconjunctivitis, but on no occasion was more than a trace of streptolysin demonstrated in the reduced filtrate when the streptococcus isolated from the pseudomembranous conjunctivitis case was used, indicating that the latter was a poor streptolysin producer.

The production of exotoxin: A toxin was produced by growing the organism for 18 hours in modified Douglas tryptic digest broth as advised by Veldee[72], and filtering through a Mandler "regular" filter. The amount of toxin required to give a reaction equal to that obtained from one human skin-test dose of scarlet-fever streptococcal toxin was determined by a series of graduated injections into the ears of rabbits. In this manner the strength of the toxin was found to be approximately 1250 S.T.D. per cubic centimeter which showed that the organism was also a poor toxin producer.

Neutralization of specific exotoxin by scarlet-fever streptococcal antitoxin: One unit of scarlet-fever streptococcal antitoxin, the amount necessary to neutralize 50 S.T.D. of scarlet-fever streptococcal toxin, was mixed with 50 S.T.D. of specific toxin and incubated at 37° C. for 30 minutes. The mixture was then injected intradermally into the shaved backs of rabbits. Separate injections of 1 unit of antitoxin and 50 S.T.D. of toxin were made at the same time for controls. The almost complete absence of skin reaction to the toxin and antitoxin mixture showed that the specific toxin was almost completely neutralized by the antitoxin.

The **production of agglutinins:** Six rabbits were given 7 weekly intravenous injections of gradually increasing quantities of living organisms. The intial dose contained one sixteenth of the 24-hour growth on a blood-agar slant; the largest dose contained sixteen times as much as the initial dose. One rabbit died after the fourth injection and two others after the seventh; one of the three rabbits which recovered from the injections developed an erysipelas of the injected ear. None of these animals developed an agglutinin titer as strong as 1:25. Two other rabbits which were given 8 biweekly injections of increasing amounts of killed streptococci and 10 injections of living organisms developed a titer of 1:25.

These experiments showed that the organism was a poor agglutinin producer and offered an explanation for the absence of demonstrable agglutinins in the blood serum of the patient.

The **experimental production of**

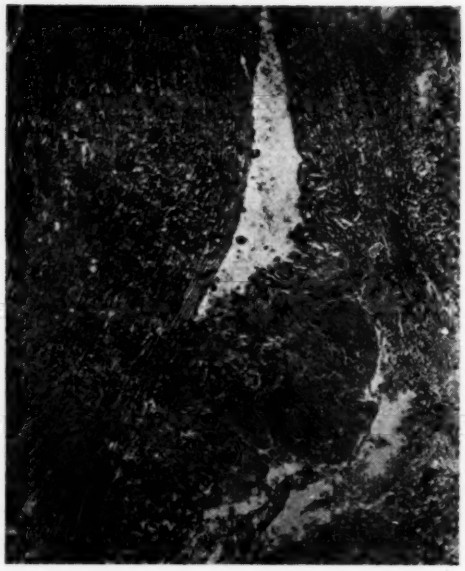

Fig. 7 (Kluever). Pseudomembrane X45.

pseudomembranes: A pseudomembranous conjunctivitis was produced in rabbits by subconjunctival injection of the Streptococcus haemolyticus and its toxins. Daily subconjunctival injections, the first two consisting of 1 c.c. of filtrate of an 18-hour culture in modified Douglas tryptic digest broth (1250 S.T.D. exotoxin), the second two of 1 c.c. of filtrate of an 8-day culture in peptone broth (endotoxins) and the fifth of 1 c.c. of a heavy suspension of the living organisms, produced a small conjunctival pseudomembrane which, however, disappeared within ten days. Rabbits injected with toxins only or with living organisms only did not develop pseudomembranes. Repeated intravenous injections of living organisms and scarification of the conjunctiva did not produce pseudomembrane formation.

Fig. 8 (Kluever). Pseudomembrane X280.

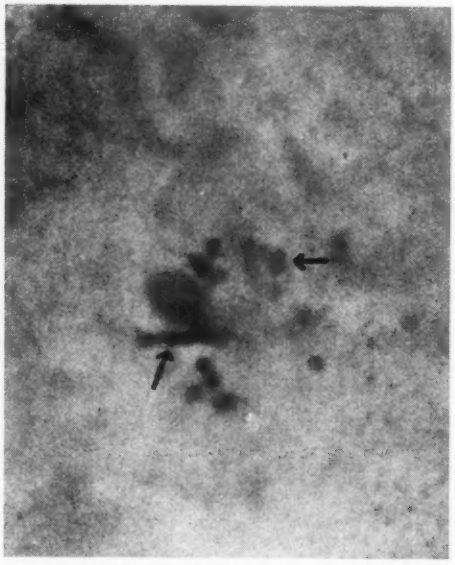

Fig. 9 (Kluever). Diplococci and chain of cocci in pseudomembrane X1800.

Subconjunctival injections of toxins and living organisms in a rabbit which had previously been given six weekly intravenous doses of living organisms produced an extensive pseudomembrane covering the entire conjunctiva of the injected lid. This pseudomembrane persisted for twelve weeks; Streptococcus haemolyticus was cultured from this conjunctiva for seven weeks.

Pathological Studies

Sections of pseudomembranes stained with hematoxylin and eosin were composed chiefly of rose red, irregularly arranged bands and skeins of homogeneous refractile material which

Hanke[12] considered to be hyalinized fibrin. Imbedded in this material were plasma cells, polymorphonuclear leukocytes, lymphocytes, erythrocytes, and large mononuclear cells, all in various stages of degeneration. Large numbers of Gram-positive diplococci and cocci in short chains were found at intervals in sections of detached pseudomembranes. These intervals were coincident with those during which Streptococcus haemolyticus was cultured from the conjunctiva. No cocci were ever found in detached pseudomembranes removed at intervals coincident with those during which the organism was not cultured.

Sections of granulomata showed a central highly vascular mass of granulation tissue which was heavily infiltrated with plasma cells and surrounded by a ring of islands of epithelium which, in turn, was surrounded by pseudomembrane; cocci were never found.

The pathology of the enucleated eye was limited to the anterior segment; the cornea, iris and lens showed the greatest changes and the ciliary body and suspensory ligament the least.

The cornea was replaced by a staphyloma; its margin was covered with epithelium and contained remnants of corneal stroma and Descemet's membrane, but the central three fifths was free from epithelium and contained no corneal tissue. The anterior surface of the central area was covered with a pseudomembrane which reached a short distance beneath the remnant of marginal corneal epithelium, with projections to the posterior surface of the staphyloma. The laminae of the remnant of corneal stroma as well as the remnant of Descemet's membrane were lost centrally in the strands of connective tissue and fibrin, hyalinized fibrin bands, blood-vessel network and cellular infiltration of plasma cells, eosinophils, large mononuclear cells, and lymphocytes which composed the structure of the central three fifths of the staphyloma. No cocci were found in any of the sections of the enucleated eye.

Remnants of iris lined the staphyloma posteriorly; iris stroma persisted only in the pupillary region and near the limbus. These remnants of stroma were densely infiltrated with plasma cells, a few lymphocytes, large mononuclear cells, plasma-cytoid cells, and Russell's bodies.

The anterior surface of the lens was covered with a thick layer of connective tissue which was bound to the posterior

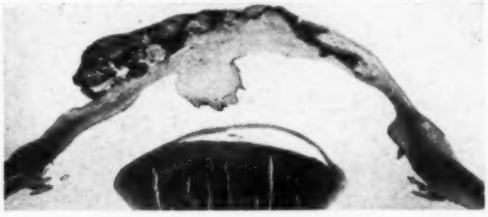

Fig. 10 (Kluever). Section showing the cornea of left eye 7 months after onset of disease.

surface of the staphyloma by fine strands composed of connective tissue and fibrin, infiltrated with many plasma cells, a few pigmented iris-epithelial cells, and pigment granules. The lens was cataractous.

The ciliary body was normal except for a moderate proliferation of its pigmented and nonpigmented epithelium. The anterior chamber was obliterated. The posterior aqueous chamber contained a small amount of fibrin and an occasional macrophage filled with pigment granules. The posterior segment of the eye appeared to be normal.

Discussion

Early investigations of the etiologic factors of this case of pseudomembranous conjunctivitis were hopelessly confused because the Streptococcus haemolyticus disappeared from the conjunctiva soon after the patient's first admission to the hospital, although pseudomembrane formation continued. Had it not been for the reappearance of streptococci along with an exacerbation of the conjunctivitis accompanying the attack of mumps, the etiologic factor would have remained unknown. The course of events following the attack of mumps was a repetition of the earlier course of the disease; streptococci were demonstrable for 12 weeks, then disap-

peared for 11 weeks, and reappeared for the last time for 5 weeks following the attack of acute pharyngitis. Pseudomembranes were present in the socket throughout this period of 28 weeks.

Gram-positive diplococci and cocci in short chains were found in the pseudomembranes during the intervals in which Streptococcus haemolyticus was cultured from the conjunctiva, but a careful search failed to demonstrate this organism in pseudomembranes, granulations, or the enucleated eye during the intervals when the organism could not be cultured from the conjunctiva. Since the organism reappeared at long intervals it was assumed that it was actually present at all times in the *subconjunctival* tissues even though it could not be demonstrated, and that the condition was really a subconjunctivitis. Hanke[12] was able to demonstrate streptococci in deep inflamed tissues as well as in pseudomembranes, but since he found them in the deep tissues of one eye only he concluded that they were secondary invaders and not the true etiologic factor in the production of pseudomembranes. If, in the present observation, the organism were actually a secondary invader, then neutralization of its toxins with antitoxin and immunization of the patient should have had little or no effect upon the course of the disease.

Hemolytic streptococci are known to produce two distinct types of toxins: exotoxins and endotoxins. The investigations of Clark and Felton[73], the Dicks[74, 75], and Williams[76] have resulted in a clearer understanding of the fundamental nature of the exotoxins; the investigations of Wright and Douglas[77], Wright[78], Neufeld and Rimpau[79], Buxton and Torrey[80], Gay and Clark[81], and Tunnicliff[69] are cited in reference to studies of endotoxins.

Williams[82] believes that: "An antitoxin stimulated by the exotoxin of any strain be it from scarlet fever, meningitis, erysipelas or any other disease process, would if strong enough protect against further injury by the exotoxin of most strains in most people." On the basis of this contention scarlet-fever streptococcal antitoxin was used. The first injection of 300,000 units of antitoxin, administered six weeks after the onset of an exacerbation, resulted in gradual disappearance of the pseudomembrane from the right eye. The third injection of 300,000 units was given almost immediately after an exacerbation and the conjunctiva of the right eye was entirely free from pseudomembrane within 24 hours.

Endotoxins are more limited in their activity than are exotoxins. Williams[83] states: "An efficient antibody (tropin) may be stimulated only or chiefly by injection of a type strain similar to the one causing the disease." Gay[84] cites the fact that in animal experimentation with erysipelas, intradermal inoculation protects the animal against intradermal reinoculation but not against intravenous inoculation, and intravenous inoculation protects against intravenous reinoculation but not against intradermal inoculation. Kahn[85] has found that the immunological response of the skin as measured by its capacity to combine with antigen is far greater than that of *in-vivo* plasma. The investigations of these and other authors assured the greatest possible immunologic response from intradermal injections of autogenous vaccine, yet an exacerbation of pseudomembrane formation in conjunction with the acute pharyngitis occurred six weeks after completion of the second course of intradermal injections.

Since immunization to autogenous vaccine (endotoxins) was insufficient to control the disease, immunization to scarlet-fever streptococcal toxin (exotoxins) was undertaken and successfully completed by beginning with small doses of toxin. A streptococcal toxoid (Veldee[72]) might have facilitated the immunization by permitting larger initial doses.

An attempt to build up a local immunity with Besredka's filtered broth vaccine as suggested by Vancea[21] resulted in a violent exacerbation which was probably due to absorption of toxins in great quantities. One exacerbation also resulted from intradermal administration of too much autogenous vaccine. Scarlet-fever streptococcal toxin when given subcutaneously in even

the smallest possible doses resulted in reformation of pseudomembranes on the conjunctiva of the right eye and in the vagina. In rabbits pseudomembrane formation resulted from subconjunctival injections of living organisms only when the local resistance had previously been lowered by subconjunctival injections of specific toxins, and only persisted for a long period when the general resistance also had been lowered by intravenous injections of living organisms.

Laboratory studies showed that the organism was a poor toxin, streptolysin, and agglutinin producer, characteristics which could be expected of an organism producing a disease of great chronicity. It seems possible that such an organism might remain dormant beneath an apparently normal conjunctiva for long intervals and only manifest its presence on occasions when the general resistance of the host is lowered. Little or no immunity was produced by the presence of the organism in the tissues of the host. If immunization were possible it could be expected only after an extensive course of injections of the toxins of the specific organism, supplemented by immunization to an exotoxin of high concentration (scarlet-fever streptococcal toxin) capable of producing an antitoxin which would neutralize the exotoxin of the specific organism.

Conclusions

1. Pseudomembranous conjunctivitis complicated by pseudomembranous vaginitis and acute glomerular nephritis persisted for 30 months and resulted in the loss of one eye.

2. Streptococcus haemolyticus was repeatedly isolated from the pseudomembranes.

3. Scarlet-fever streptococcal antitoxin exerted a favorable effect upon the disease.

4. Subcutaneous administration of scarlet-fever streptococcal toxin, intradermal administration of autogenous streptococcal vaccine, and local application of filtered autogenous broth vaccine (Besredka) stimulated the formation of pseudomembranes.

5. The lesions of the right eye and vagina healed after attempted immunization with autogenous vaccine and scarlet-fever streptococcal toxin.

6. Comparable pseudomembranes were produced experimentally in rabbits with subconjunctival injections of Streptococcus haemolyticus and its toxins.

7. When the inefficacy of ordinary therapeutic measures is contrasted with the results obtained in this case, it seems justifiable to recommend the use of scarlet-fever streptococcal antitoxin in cases of pseudomembranous conjunctivitis which are not due to readily recognizable causes.

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Discussion. DR. EUGENE M. BLAKE: I should like to ask Dr. Kluever whether blood cultures were made.

DR. KLUEVER: They were made, but the organism was never grown.

DR. BLAKE: Blood count?

DR. KLUEVER: The blood count remained constant at 9,000 to 11,000; it was higher, of course, during the attacks of acute pharyngitis.

DR. F. H. VERHOEFF: The conjunctivitis first appeared at the age of six years, never before?

DR. KLUEVER: She gave a history of having had pseudomembranes of either one or both eyes at earlier occasions, but they never persisted for longer than two or three weeks.

DR. VERHOEFF: Did she have them as an infant?

DR. KLUEVER: She had impetigo shortly after birth. On that occasion the mother observed that the child had a conjunctivitis, but she did not remember having seen pseudomembranes. If pseudomembranes were present they persisted for only a few days.

DR. THOMAS B. HOLLOWAY: How long had she had serious manifestations of the right eye, approximately?

DR. KLUEVER: She had serious manifestations of the right eye for about a month. The right eye was not involved until she had the attack of mumps; impairment of vision was present with this exacerbation for about two weeks. She had photophobia, itching, and burning of the right eye; very small fine threads and very faint pseudomembranes appeared below the cornea on the bulbar conjunctiva.

DR. VERHOEFF: Do you think the streptococcus disappeared in time?

DR. KLUEVER: Streptococci were not found on careful examination of repeated cultures and scrapings during a period of four months following disappearance of the organism after the patient's first admission to the hospital. Yet streptococci recurred during the exacerbation occurring in conjunction with the attack of mumps.

DR. VERHOEFF: Do you have a theory concerning recurrences? As to where it came from?

DR. KLUEVER: A few organisms apparently persisted in subepithelial tissues (beneath the conjunctiva) even though their presence could not be demonstrated.

DR. VERHOEFF: How did she get it?

DR. KLUEVER: That is not known. The recurrences, I believe, resulted because of the persistence, subconjunctivally, of dormant single undemonstrable organisms. The streptococcus may persist in apparently healed bone lesions for long periods of time and in conjunction with slight trauma cause the recurrence of an active lesion with many demonstrable organisms.

DR. VERHOEFF: Did you let the granuloma go for a long time to see what happened?

DR. KLUEVER: Yes, it filled the entire socket.

DR. VERHOEFF: I mean in the right eye.

DR. KLUEVER: A small granuloma, 3 mm. to 6 mm. in diameter, grew from a base 2 mm. in diameter and spread out like a mushroom on the upper right eyelid.

DR. VERHOEFF: Did the base get larger?

DR. KLUEVER: No, the base contracted down; the contraction was helped by removing the granuloma with scissors without traumatizing the surrounding conjunctiva.

DR. VERHOEFF: That is what I meant. It seemed to me the base would get pretty small before you do anything. If you let it stay there it gets smaller.

DR. KLUEVER: The condition improved when left alone for certain periods of time. After that it remained unchanged and was helped along by removal with sharp scissors.

DR. VERHOEFF: That is what you want.

DR. HOLLOWAY: Weren't there very fine tumor masses?

DR. KLUEVER: Yes.

DR. HOLLOWAY: Always the membranous type?

DR. KLUEVER: The tumor masses were granulomata covered with attached strands of pseudomembrane.

THE LYSOZYME CONTENT OF TEARS

WILLIAM M. JAMES, M.D.
SAINT LOUIS

Tears were collected with capillary pipettes from 100 clinically normal persons without irritating the eyes, and the bacteriolytic titer was determined under standard conditions, using M. lysodeikticus as the test organism. No relationship could be established between the titer variations and the age, sex, or race of the subject. Acute corneal lesions with sustained epiphora were investigated with respect to the value of the titer present, and this was found to be reduced in syphilitic keratitis, ulcerative keratitis, and in trachoma with active corneal changes. Nonspecific foreign protein had no effect on the lysozyme content in iridocyclitis after atropinization of the eyes. Pooled samples of tears had no effect, macroscopically, on bacteria cultured from the conjunctiva, but the bacteriostatic action of lysozyme was apparent on all the organisms tested. No bacteriolytic action was demonstrable on three strains of B. granulosis nor on strains of virulent staphylococcus. The effect of collyria on the bacteriolytic action of tears was determined. Strains of bacteria resistant to lysozyme develop rapidly when the organism is grown in the presence of lysozyme. From the Department of Ophthalmology, Washington University School of Medicine. Read before the Association for Research in Ophthalmology, Atlantic City, June 11, 1935.

The problem of resistance to infection and the response of the organism to injury, be it traumatic or chemical, is extremely complicated and not well understood. Every organ and tissue of the body is variable in structural arrangement, histological appearance, and in its nerve and blood supply. The inheritance, race, preëxisting infections, and age of each individual person influence his reaction to injury. The anatomical placement of certain organs renders them liable to more or less specific types of bacterial invasion or trauma. The ocular structures are well protected by the arrangement of the orbit and the location of the eyeball. The relative infrequency of inflammatory changes in the conjunctiva as compared with the frequent explosive reactions of the nasal mucous membrane excites curiosity. The free flow of lacrimal secretions and the uninterrupted drainage of the secretions with the mechanical action of the lids are generally thought to be the most important defensive factors in dealing with the bacteria that lodge upon the conjunctiva.

Until 1922, the opinion was held by most observers that little or no bactericidal property could be attributed to the tears *per se*. Alexander Fleming[1] reported in 1922, "on a remarkable bacteriolytic element found in tissues and secretions." This element was found in the nasal secretion of a patient with an acute coryza from which an organism, Micrococcus lysodeikticus, was isolated. The bacteriolytic element was named "lysozyme" by Fleming, suggesting that it is an enzyme and that its action is chiefly lytic, although bactericidal and bacteriostatic powers were soon demonstrated. The lytic action is most spectacular and has been stressed more than the bactericidal or bacteriostatic action by subsequent investigators. Fleming's original report stated that all tissues contain lysozyme in varying amounts, tissues of epidermal type, such as the mucous membranes of the respiratory tract or the membranes of the joint surfaces, being especially rich in this bacteriolytic element. He further stated that lysozyme is not found in urine, sweat, nor in the

cerebrospinal fluid. The activity of lysozyme is influenced by temperature; it is most rapid at 60°C., is inhibited at 75°, and destroyed when kept at the boiling point for 30 minutes. As the temperature is reduced below 37° the rate of lysis is retarded but not inhibited. Filtration through cotton, charcoal, filter paper, or a Berkefeld filter removes the element from a solution. Marked changes in acidity or alkalinity delay the process although lysis does occur through a range of pH 3 to pH 10. Most pathogenic organisms isolated from the human body are not lysed. Fleming also reported that of 22 strains of streptococci studied, lysis occurred in 16. Strains of B. coli, B. typhosus, B. paratyphosus, pneumococci, diphtheroid bacilli, and B. pyocyaneus were not lysed. In 1923, Fleming and Allison[2] reported the development of resistant strains of bacteria produced by growing the bacteria in media containing lysozyme. In 1927, they also found[3] that strains of streptococci made resistant to lysozyme are more resistant to intracellular digestion by leucocytes. The significance of this for the defensive properties of the leucocytes is hard to evaluate in view of the fact that lysozyme is present in the blood stream and in all tissues.

Ridley[4] investigated clinically the relationship between the lysozyme titer of tears and infections of the eye. In sustained epiphora the titer is reduced from 30-60 percent of normal. This was also found in vitamin deficiency, phlyctenular disease, and interstitial keratitis. He concluded that the efficacy of atropine may be due to the increased lysozyme titer which results from the decrease in the amount of lacrimal secretion following atropine instillation. The comparative lysozyme content of tears is 100; of leucocytes 100; of sputum 33; of nasal mucus 33; of saliva 1; of cartilage 10; and of egg white 200. Hallauer[5] reported his findings in 1930. In normal individuals lysis was produced in dilutions of tears of 1:10,000 to 1:100,000. In acutely inflamed eyes the titer was reduced, but chronic inflammatory reactions were not accompanied by a reduction in lytic power. There was no apparent relationship between the lysozyme content and the presence or absence of organisms as determined by the bacteriological examination of smears. Zinc drops instilled for several weeks produced an increase in lysozyme. In phlyctenular disease the use of calomel powder and yellow oxide ointment was attended by an increase in titer: atropine produced a striking increase in lytic power. Findlay[6] working with rabbits reported that in vitamin-A deficiency keratomalacia could be prevented by instilling normal tears into the conjunctival sacs. Also he found a reduction of lysozyme titer of the tears of the rabbits on the deficient diet. Allison[7] was unable to increase the lysozyme of tissues or secretions by active immunization with the same organisms. Karl Meyer[8] and coworkers state that lysozyme is an enzyme mixture which splits off a reducing sugar from the mucoids and polysaccharides obtained by hydrolysis of the test organisms. An aqueous solution of their material obtained from egg white did not alter the surface tension of water, and had no proteolytic, lipolytic, nor amylolytic action.

Experimental

Method. Through the kindness of Dr. L. A. Julianelle, a stock culture of Micrococcus lysodeikticus was obtained. The technique of the tests was worked out using egg white as a source of lysozyme; and the investigation of tears was run in parallel with dilutions of egg white of known titer. With the organism used, the stock egg-white solution would produce lysis macroscopically in a dilution of 1:25,000 in one hour at 40°C. Tears were collected by inserting a capillary glass tube into the conjunctival sac at the outer canthus. Usually a satisfactory sample could be obtained without reflex irritation; if not, the subject was given a whiff of aromatic spirits of ammonia. Dilutions of the tears were made with normal saline, using a capillary pipette of the type used for counting red blood cells, to obtain the first dilution of 1:100.

Material. A series of one hundred cases of clinically normal individuals was studied. The lysozyme titer varied

from 1:1600 to 1:12,800, there being no apparent relationship between the age, sex, or color of the subject and the value of the titer. In the above series 40 negroes were included in an effort to find a possible difference in lysozyme that might have some relationship on the immunity of the negro to trachoma. This was not shown (fig. 1).

Twenty-two cases of acute corneal lesions with sustained epiphora were investigated. In six cases of syphilitic keratitis, the lysozyme titer of tears from the involved eye varied from 1:400 to 1:3200 as compared with a titer in the uninvolved eye of 1:1600 to 1:6400. In three cases of dendritic keratitis a persistently low reading of 1:400 to 1:800 was obtained. Thirteen cases of ulcerative keratitis presented a reduced lysozyme titer of 1:400 to 1:1600. This group comprised patients with embedded corneal foreign bodies.

Twenty patients with trachoma were tested: in six, with marked epiphora

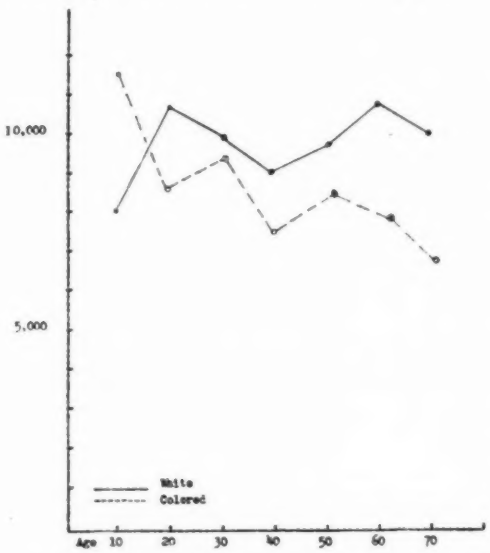

Fig. 1 (James). The lysozyme titer of tears in the white and colored races at various ages.

and active corneal lesions the lysozyme titer was reduced to 1:200 to 1:800. In fourteen, who were in the chronic healed stage without tearing, the titer was within normal limits; i.e., 1:1600 to 1:12,800 (fig. 2).

The effect of nonspecific foreign protein on the lysozyme content was determined in six cases of iridocyclitis. The titer in the involved eye was determined twenty-four to forty-eight hours after atropinization and again twenty-four hours after the use of foreign pro-

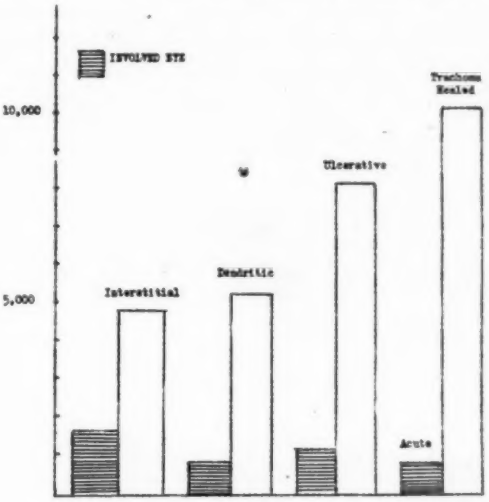

Fig. 2 (James). The lysozyme titer of tears in various forms of keratitis.

tein. Typhoid vaccine intravenously, or Park Davis Biological #615, a stock mixed vaccine, was used. There was no appreciable alteration in these cases after repeated use of the foreign protein, which produced some improvement both subjectively and objectively in the iridocyclitis.

The action of pooled samples of tears on organisms from the conjunctiva isolated by culture on blood-agar plates was tested. Sixty-three positive cultures were obtained. No attempt was made to identify the bacteria except by Gram's staining. In no case was lysis obtained with the use of a dilution of tears of 1:100. The bacteriostatic action of lysozyme was easily demonstrated in all the cultures if in making a subculture the platinum loop was dipped in tears before the bacteria were picked up. Growth on the subculture usually became apparent at the end of forty-eight hours and then progressed rapidly.

Eight virulent strains of staphylococci were obtained from Dr. L. A. Juli-

anelle. They were resistant to lysis by tears diluted 1:100. Three strains of the Bacterium granulosis of Noguchi were also resistant to lysozyme.

The effect of the following collyria on the action of lysozyme was determined when these were substituted as diluents in the place of normal saline.

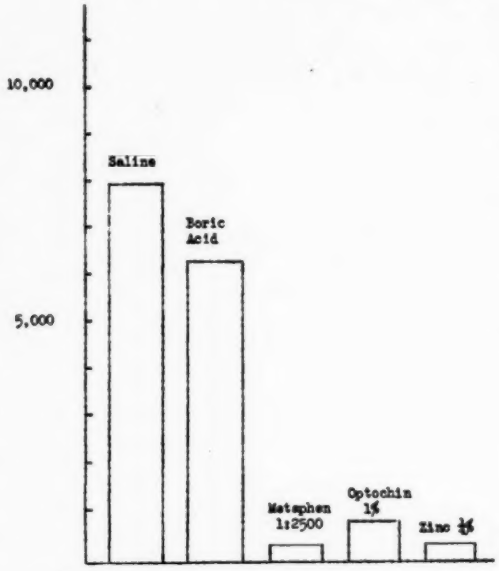

Fig. 3 (James). The action of collyria on the lysozyme titer of tears.

Samples of tears and of egg white were used. A saturated boric-acid solution with tears diluted 1:6400 produced complete lysis in one hour. Metaphen 1:2500 inhibited lysis and a heavy growth of Micrococcus lysodeikticus was obtained on subculture. Optochin in a 1 percent solution reduced the lytic action to 1:800. Zinc sulfate (0.25 percent solution) prevented lysis. Using the above collyria the titer of tears was determined. The eye was flushed freely with one of the solutions and the titer was rechecked on specimens of tears at fifteen-minute intervals for one hour. No change of lysozyme titer occurred (fig. 3).

The development of strains of bacteria resistant to lysis was produced very easily by making subcultures from the higher dilutions of lysozyme and bacteria in which only partial clearing of the bacterial suspension had occurred. Growth on subculture was delayed sometimes as long as five to seven days; but the organisms which finally grew were very resistant to lysis.

Discussion

The presence in the lacrimal secretion of a powerful bacteriolytic and bacteriostatic element is an important defense against the invasion of the tissues by bacteria. The majority of airborne organisms are completely lysed by tears; the bacteria which develop in the presence of tears and are isolated on culture from the conjunctiva are resistant to lysis. The inhibition or retardation of the growth of these bacteria still occurs, however, and undoubtedly allows time for the mechanical action of the lids and the lacrimal flow to sweep away bacteria which would develop if allowed to remain on the mucous membrane an indefinite period of time. The presence of bacteria on the conjunctival membrane can be determined either by examining the smears directly or by culturing or is inferred from the clinical signs of inflammation. The mixture of lacrimal secretion and bacteria, such as is obtained with a platinum loop in taking conjunctival cultures, often yields negative results in twenty-four hours; however, if the cultures are examined at a later time positive cultures will be obtained more frequently.

The profuse lacrimation that follows the instillation of silver-nitrate solution into the eyes of the newborn probably contributes to the efficiency of the Credé method of preventing ophthalmia neonatorum. Certainly the bactericidal action of one drop of a 1- or 2-percent solution of silver nitrate is neither great nor long continued.

The phagocytic action of many types of body cells has been demonstrated repeatedly. The mechanism of phagocytosis and lysis is considered by many immunologists to be fundamentally the same; that is, a specific antibody sensitizes the invading organism so that lysis occurs. In one case this occurs outside the cell, in the other lysis occurs within the cell. The concurrent development by bacteria of resistance to ly-

sozyme and of resistance to intraleucocytic digestion has been demonstrated by Fleming and Allison.

The fall in the lysozyme content of tears with continued epiphora, with vitamin deficiency, and with corneal lesions, indicates that if the eye is to be protected the cause of the epiphora should be removed, a diet adequate in vitamins maintained, and the normal flow of tears and the mechanical action of the lids not inhibited. Although most pathogenic bacteria are resistant to lysis they are still susceptible to the bacteriostatic action of tears; however, if there is an opportunity for the bacteria to remain in long-continued contact with interstitial keratitis, you know it velops with increased resistance to the lytic action of the secretions and to the phagocytic action of the body cells.

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Discussion. DR. FREDERICK H. VERHOEFF: I should like to ask whether you investigated the effect of cocaine.

DR. JAMES: The effect of cocaine was not satisfactorily determined. A mixture of tears, saline, and cocaine solution was cloudy and the lytic end point was not satisfactorily read.

DR. VERHOEFF: Another point came to mind: You pointed out that in certain diseases, for instance in keratitis, the lysozyme content was low. You would not, of course, think that there would be any connection there. In other words, it seems to be low when you have a congested condition of the conjunctiva. Then that would raise the question of what makes it low; whether it could possibly be mixture with serum or some exudate.

DR. JAMES: The reduction in lysozyme titer was seen in diseases with little or no exudate or conjunctival congestion. Sustained epiphora causes reduction in titer, which may be due to dilution rather than to a quantitative loss.

DR. VERHOEFF: Then, in connection with interstitial keratitis, you know it is low. Did you investigate the question of whether the herpes virus is affected by normal tears, tears from another person?

DR. JAMES: The herpes virus was not investigated.

THE BACTERIAL FLORA OF THE NORMAL CONJUNCTIVA

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The results of 1,122 preoperative cultures of noninflamed conjunctivae are summarized. Staphylocci and diphtheroids are the most frequent bacterial habitants of the normal conjunctiva. Other organisms occur in a relatively small percent of cases. The incidence of diphtheroid organisms increases markedly with advancing age, the increase being most pronounced in the 30- to 50-year group. Pneumococci and green streptococci occur most frequently in children under five. From the Laboratory of Bacteriology of the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University, and the Institute of Ophthalmology of the Presbyterian Hospital, New York City.

Axenfeld[1], in 1908, stated that, while B. xerosis and Staphylococcus albus are most frequently found on the normal conjunctiva, many other organisms, including Staphylococcus aureus, pneumococci and streptococci, are found in varying percentages of cases studied. Investigations[2-8] reported since the publication of Axenfeld's book have not essentially affected the truth of this statement, and future investigations will probably not materially modify it. However, one or two points revealed by the analysis of the results of preoperative cultures on 1,122 noninflammatory cases seem to us to justify a very brief report of these cultures.*

Technique. Cotton swabs, moistened in 1-percent glucose infusion broth, were firmly rubbed back and forth several times over the greater part of the lower tarsal conjunctiva, avoiding the lid border and lashes. The swab was immediately rubbed over the surface of a sheep's or rabbit's blood-agar plate and then replaced in the glucose broth. A second swab was used to inoculate a tube of chopped meat broth. Moist swabs were found to yield a greater percent of positive cultures than dry swabs. The washing of the sac by broth introduced and sucked up again by a capillary pipette gave no more positive cultures than the moist swabs. This method seemed to us to offer more chance of contamination, and was decidedly more awkward, especially in refractory patients.

The results of the cultural findings are summarized in tables 1 and 2.

The problem of the **differentiation** of staphylococci is one on which much active work is being done at the present time[9-14] and in the near future will probably be on a more satisfactory basis than at present. When the staphylococci cultured from these cases were differentiated by the color of the massed organisms placed on white filter paper it was found that Staphylococcus aureus occurred in 23 percent of the cases and albus in 41 percent. One hundred and three of the cultures of staphylococci were tested for mannite fermentation and coagulation of human plasma. Eighty-five strains possessed neither property, 7 strains had one property without the other, and 11 possessed both properties.

Under the heading of "Diphtheroids" are included all grampositive, nonsporing bacilli with characteristic morphology and palisade formation. According to fermentation reactions, 43 percent of

* We are indebted to the nursing staff of the Institute of Ophthalmology for their cooperation in obtaining the cultures.

Table 1

ORGANISMS FOUND MOST FREQUENTLY ON NORMAL CONJUNCTIVAE

Total Number of Cases Cultured	Percent of Cases in which Each Organism Occurred							
	Staphylococci	Diphtheroids	Strept. Viridans	Strept. Hemo.	Pneumococci	Sarcinae	More than one Organism	No Growth
1122	64	36	3.4	1.2	2.6	1	25	17

these could be regarded as C. hoffmanni, and 38 percent as C. xerosis, while the remainder showed reactions not typical of either group.

The pneumococci were differentiated from the green-producing streptococci in most cases only by morphology and by colony form. Only 4 of the cultures were typed; these were of the following types: 1, 3, 7, and 17.

Table 2

ORGANISMS CULTURED FROM LESS THAN 1 PERCENT OF CASES

	Times
B. subtilis or similar organisms	9
Proteus vulgaris	6
Yeasts and Monilia	5
Pseudomonas aeruginosa (pyocyaneus)	4
Esch. communior (B. coli communior)	3
Alkaligenes fecalis	3
Esch. acidi-lactici (B. acidi lactici)	2
Aerobacter aerogenes (B. lactis aerogenes)	1

Seasonal incidence. The numbers and relative proportions of organisms obtained varied considerably from time to time but, during the 17 months these cultures were taken, no regular seasonal variation in the incidence of staphylococci or diphtheroids could be detected. The hemolytic streptococci appeared to be more frequent from October to May, and the pneumococci from December to August, but in both cases the numbers were too small to be conclusive.

Age incidence. Table 3 shows the percent of each age group in which each species of organisms was found. One thousand and eighty-four of the 1,122 cases are included in this table.

The green streptococci and especially the pneumococci are found chiefly in young children. This is in agreement with the findings of v. Pellath[3] who, in 1912 cultures before cataract operation grew pneumococci from 19 percent of the senile cases and from 44 percent of the congenital cases. There is a very definite increase in the incidence of diphtheroids with advancing age, especially marked in the 30-to-49-year group. It is difficult to see how this could be an artefact since the culture technique was always uniform and the age groups were evenly distributed as to time. The increase in mixed cultures and the decrease in negative cultures with advancing age are probably dependent, to some extent at least, upon the increase in diphtheroids.

Table 3

AGE INCIDENCE OF ORGANISMS

	Age group					
	0–5	6–14	15–29	30–49	50–69	70–
Total cases in each group	64	106	143	220	412	139
Staph. albus in	41%	39%	43%	39%	42%	45%
Staph. aureus in	25%	24%	24%	21%	25%	23%
Strept. haemolyticus in	(1)*	(1)	3%	(1)	2%	(1)
Strept. viridans in	8%	4%	2%	3%	4%	1%
Pneumococcus in	13%	2%	2%	3%	2%	1%
Diphtheroids in	25%	24%	28%	38%	42%	45%
Mixed cultures in	26%	16%	18%	19%	30%	34%
No growth in	20%	23%	20%	20%	14%	12%

* Brackets indicate actual numbers, not percent.

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DACRYOSTENOSIS IN CHILDREN

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A survey of the clinical course of dacryostenosis in children shows a marked difference between the congenital type and the acquired forms. Congenital atresia of the nasolacrimal duct justifies a very favorable prognosis when given medical attention; if instrumentation is necessary it may satisfactorily be limited to small probes. A large proportion of the cases of acquired dacryostenosis, usually associated with trauma or disease involving the upper respiratory system, show a poor prognosis for recovery unless some major surgical procedure of the nasolacrimal drainage apparatus is performed.

Tables showing summary of forty-four case histories in thirty-six patients are included.

From the Department of Ophthalmology, Children's Memorial Hospital, Chicago.
Read before the Chicago Ophthalmological Society, December 17, 1934.

While a discussion of dacryostenosis in children is best begun by a consideration of embryological and anatomical features of the nasolacrimal drainage system, this would be merely recapitulating the very complete work already performed by Schaeffer[1], Mann[2], Whitnall[3], Gradle[4], and Onodi[5]. The most important developmental factor to be considered here is the fact that the point of coalescence between the nasal end of the solid nasolacrimal cord and the mucous membrane of the inferior nasal meatus is usually the last point in the nasolacrimal-duct system to become patent. This may be deferred to the end of fetal life or even after birth. Parsons[6] states that he has made many observations in which a membranous barrier between the nasolacrimal duct and the inferior meatus existed during the first week of infancy. Vlacovich[7], in eighteen autopsies on newborn infants, found four cases in which the nasolacrimal duct was not patent at the nasal end, while Rochon-Duvigneaud[8] reported three out of thirty newborn or stillborn infants with a similar atresia.

The thought that the cause of epiphora, mucocele, and dacryocystitis in infants might be due to this imperforation of the septum between the inferior meatus and the nasolacrimal duct in the newborn infant was first mentioned by Peters[9] in 1891, followed by Rochon-Duvigneaud[8] in 1899, and by Gunn[10] in 1900. Other etiological factors mentioned include delayed separation and necrosis of the epithelial cells in the cord, retention of a plug of these necrotic cells in an otherwise patent duct, folds in the duct or at Hasner's valve at the inferior meatal opening of the duct, faulty development of the embryological cartilages surrounding the nasolacrimal duct (according to Gunn), and partial occlusion due to pressure of the inferior turbinate. Zentmayer[11] considered the possibility of pressure during forceps deliveries, but stated that this thought had not been corroborated by statistics. Stephenson[12] felt the cause to be the delayed absorption of the material that exists in the sac and duct, plus infection by bacteria.

Stephenson[12] stated that 1.75 percent of 1,538 out-patients of a children's hospital had lacrimal obstruction shortly after birth, with or without infection. Kipp[13], back in 1879, found that ten percent of all cases of dacryocystitis, including phlegmon of the sac, occurred

in children under one year of age. Statistics are of little avail, as far as incidence is concerned, since, according to Weeks[14], secretion of lacrimal fluid may begin at a period three to eight weeks after birth, and by this time many of these occluded ducts have become patent. The symptoms, therefore, may not begin until a month or more after birth, and then may be simply epiphora, or may go on to a mucoid or mucopurulent discharge and hydrops of the sac with discharge on pressure. This discharge, by the way, may not return through the punctum by pressure over the sac, but may be forced through the duct into the nose.

A great many bacteria have been recorded[12, 15] as resident in these congenitally obstructed passages, including the pneumococcus, the colon bacillus, Staphylococcus pyogenes aureus, Morax-Axenfeld bacillus, xerosis bacillus, and the pneumobacillus. The varied opinions of the authors of previous articles on this subject probably are all correct, for any opinion as to the sterility or degree of infectiousness in any case of dacryostenosis in infancy must depend entirely on the individual case.

The prognosis is generally conceded to be very good, barring phlegmon formation; and even then it is usually good. Danger to the cornea, in view of possible abrasion of this surface, must be considered, but reports of such occurrences in infants are surprisingly rare.

Recommendations for treatment of congenital dacryostenosis are numerous and varied. Wood[16], Weeks[14], Jackson[17], and Peters[9] have recommended very conservative treatment, consisting of mild antiseptics and massage over the sac for several months while waiting for nature to complete its job of opening the nasolacrimal duct; while Parsons[6] (who is against probing in adults), Cutler[18], Gifford[19], and Mayou[20] recommend probing or syringing early. The mildest method of interference suggested is that of irrigation of the sac for the dual purpose of removing impacted epithelial debris and of breaking through a thin membrane, if present, by hydrostatic pressure. Those who recommend conservative treatment usually will probe, if the symptoms have not subsided within two to six months.

Those who advocate probing either

Table 1

CONGENITAL DACRYOSTENOSIS CURED AFTER CONSERVATIVE TREATMENT

Number	Eye	Age of Onset	Age at First Treatment	Duration of Conservative Treatment	Remarks
Case 1	R	4 weeks	8 months	6 weeks	
Case 2	R	1 week	1 month	12 weeks	
	L	1 week	1 month	8 weeks	
Case 3	R	3 weeks	2 months	4 weeks	Had associated rhinitis
	L	3 weeks	2 months	14 weeks	
Case 4	R	8 weeks	11 months	2 weeks	
	L	8 weeks	11 months	2 weeks	
Case 5	R	12 weeks	17 months	2 weeks	Slight epiphora in cold weather
Case 6	L	4 weeks	2 months	8 weeks	Had to irrigate other eye
Case 7	R	4 weeks	6 months	1 week	
Case 8	L	2 weeks	1 month	3 weeks	
Case 9	R	2 weeks	1 month	6 weeks	
Case 10	L	5 weeks	20 months	3 weeks	
Case 11	R	12 weeks	4 months	2 weeks	Slight hydrocephalus
	L	12 weeks	4 months	6 weeks	
Case 12	R	1 week	½ month	7 weeks	Left duct had to be probed
Case 13	R	24(?) wks.	12 months	4 weeks	Question observations of parents
Case 14	L	1 week	7 months	1 week	Epiphora R and L in cold weather
Case 15	R	12 weeks	5 months	4 weeks	Epiphora R in cold weather
Case 16	R	1 week	4 months	2 weeks	
Case 17	R	2 weeks	24 months	8 weeks	Dry except in sudden cold

shortly after birth or after waiting any length of time, differ greatly in their choice of the size of probe, varying from the technique of Herbert Fisher[21], who favors using a small probe through an undilated canaliculus, through the list of men such as Weeks[14], who slits the canaliculus and uses a number four or number five Bowman's probe, to the technique advocated by Gifford[19], who Gunn[10], and Woodruff[23], have mentioned an important fact; namely, that it is often necessary to be sure that the probe is through into the inferior meatus, and that occasionally it is necessary to rub the probe with another probe through the nose to insure perforation of the occluding membrane. In one case, after repeated probings, Berry found it necessary to remove part of

Table 2

CONGENITAL DACRYOSTENOSIS, REQUIRING FURTHER CONSERVATIVE TREATMENT

Number	Eye	Age of Onset	Age at First Treatment	Duration of Conservative Treatment	Remarks*
Case 18	L	2 weeks	4 months	9 months	Cured 1 wk. after probing
Case 19	R	3 weeks	6 months	12 months	Previously had superior canaliculotomy and large probe passed. Cured after #2 Bowman's probe passed
Case 20	R	2 weeks	2 months	none	Had phlegmon—incised and small probe passed. Cured in few weeks
	L	2 weeks	2 months	none	Had phlegmon—incised, probed, and irrigated. Cured in 7 weeks
Case 6	R	4 weeks	6 months	4 months	Irrigated 5 times in 1 yr. Cured after 16 months
Case 21	L	4 weeks	2 months	3 months	Cured 1 mo. after probing. Had aborted abscess LLL after probing
Case 22	R	1 week	9 months	3 months	Cured 1 wk. after probing
Case 23	R	16 weeks	7 months	2 months	Cured 1 wk. after probing
Case 12	L	1 week	½ month	8 months	Cured 5 days after probing
Case 24	L	2 weeks	3 months	12 months	Refused probing—hydrops
Case 25	R	4 weeks	7 years	none	Epiphora RE since birth. #2 probe—no tearing after 2d day. Fistula

* It will be noted that it was unnecessary to repeat the probing in any of the cases except in case 19, in which the technique had been radically different from that described.

states that no form of medication is of any value in this condition, which is usually simply relieved by passing a large probe (number ten Bowman's or the Weber probe), after slitting the upper canaliculus. He leaves this probe *in situ* for one minute, and then irrigates with normal saline solution to make sure that an opening into the nose has been effected. Gifford also states that proper diagnosis and treatment should be instituted as early as possible, since infection is very likely to occur at any time when the duct remains closed, and then the condition is as unsatisfactory to treat as chronic dacryocystitis in adults.

Several men, including Berry[22], the inferior turbinate; he could then see his probe covered with a tough elastic membrane. He cut this membrane and the sac condition cleared up after a few irrigations.

The following survey was begun to determine the clinical course of dacryostenosis in children and to find the simplest effective treatment. It soon became evident that there must be a definite division into congenital and acquired types, both as to prognosis and treatment. I am sure, however, that many have had individual cases that are not in accord with our findings. These cases must, of course, be handled as necessity demands.

In the past eighteen months at the

Children's Memorial Hospital we have seen forty-four individual cases of dacryostenosis, unilateral or bilateral, in thirty-six children whose ages varied from one month to twelve years. Thirty-two of these quite definitely came under the congenital classification, with epiphora and discharge at the inner angle of the eye shortly after birth, and the conjunctival surfaces usually normal or not sufficiently involved to account for the discharge present. There may or may not be a fullness over the sac; if present, pressure in this region will cause the return of a seromucous or a seropurulent material through the punctum or into the nose, the latter being a very desirable finding, as it may terminate the symptoms. The condition is usually unilateral, although our series shows seven bilateral cases in the group of thirty-two congenital cases. Nineteen of the cases were right-sided. The age of onset varied, probably with the observing powers of the parents, from one week to six months, the average being 1.5 months. The average age at which we first saw these cases for treatment was 5.9 months. We have elimi-

Table 3

ACQUIRED DACRYOSTENOSIS WITH ACCOMPANYING DACRYOCYSTITIS

Number	Eye	Age of Onset	Age at First Treatment	Duration of Conservative Treatment	Remarks
Case 26	R	4 years	4½ years	3 months	Scarlet fever. Dacryocystectomy Cured in 1 month
Case 27	R	3 years	9 years	4 months	Unknown. Chronic dacryocystitis. Parents refuse treatment
Case 28	R	7 years	10 years	3 months	Trauma. Pressure over hydrops causes discharge into nose. Has improved under conservative treatment
Case 29	L	7 years	7 years	none	Upper resp. infection. Phlegmon. Cured 3 wks. after incision of abscess
Case 30	R	5 years	5 years	none	Scarlet fever. Abscess ruptured. Cured
	L	5 years	5 years	none	Scarlet fever. Incised abscess. Cured
Case 31	R	3 years	3½ years	6 months	Trauma. Impacted fracture of right alveolar process of maxilla. Probe met obstruction at lower end of sac. Dacryocystectomy was followed by superficial abscess. Now cured after 5 months
Case 32	R	2½ years	5 years	24 months	Unknown. Course intermittent with normal periods. Conservative treatment
Case 33	R	2 years	2½ years	none	Trauma. Associated with skull fracture. Probe met bony obstruction. 3 recurrent abscesses before parents would consent to removal. Dacryocystectomy. Cured in 5 weeks
Case 34	R	3 years	3 years	18 months	Foreign body (cork) in nose. Fluid irrigates through into nose. Still has some epiphora and discharge. Not a hydrops.
Case 35	L	5 years	5½ years	10 months	Bronchopneumonia. Subacute abscess with fistula still draining. To have dacryocystectomy.
Case 36	R	8 years	8 years	9 months	Scarlet fever. Dacryocystectomy. Cured 1 month later

nated from the statistics one child who was seven years old when first seen with what was probably a congenital fistula over the sac and an epiphora which, her mother said, dated from the time when she was less than one month of age. The youngest child seen for treatment was two weeks old, having bilateral epiphora and mucocele. It is an interesting observation that there seems to be no definite relationship between the time of first treatment and the time of relief. The infant just mentioned recovered from her right-sided obstruction in six weeks under conservative treatment, while the left side showed no improvement until after a probing had been done at seven months. The average age of first treatment in the cases needing probing was 4.2 months, or 1.7 months less than the general average age of first treatment.

These thirty-two cases with congenital obstruction were placed on conservative therapy of a mild antiseptic and digital pressure over the sac for an average period of 2½ months. Our choice of antiseptic was one-percent aqueous mercurochrome solution, which had the added advantage of indicating by its distinctive color any that might reach the nose or nasopharynx. We instructed the mother to apply pressure by placing the finger just laterally to the inner canthus and pressing medially and down, thus using any material in the sac as a hydraulic ram in an effort to break through the imperforation of the nasolacrimal duct. Twenty-one of these congenital cases required no more radical treatment than this, the symptoms being arrested in an average time of 1.4 months after start of treatment, the extremes being one week and 3½ months.

Eleven of these thirty-two cases did not respond to such conservative therapy after an average trial period of 4.5 months. One infant had bilateral obstruction with phlegmonous formation at less than two months, both abscesses being incised and their nasolacrimal ducts probed. One side recovered in a week while the other side required a second probing before recovering. This was the only case of phlegmonous formation in our series of congenital dacryostenosis, and even here recovery was not extremely difficult to obtain. In the eleven obstinate cases, probing was done in nine, and irrigation in one; in one the parents refused probing. At the end of a year this patient still had stenosis and a chronic dacryocystitis.

Since we wished to find the simplest effective treatment, we began our probings in these obstinate cases without forcibly enlarging any of the presumably normal passages above the nasolacrimal duct. The punctum dilator was used sufficiently to allow the entrance of number-one or number-two Bowman's probes. One patient included in our series had had the upper canaliculus slit at eight months by another man, evidently for the purpose of passing a large probe. Due to persistence

Table 4

SUMMARY OF FINDINGS

	Congenital	Acquired
Percentage right-sided	57 percent	75 percent
Percentage bilateral	28 percent	9 percent
Percentage of total series	73 percent	27 percent
Number of cases	32	12
Number of patients	25	11
Recovery—Conservative treatment	21 (65%) } 97%	None
(Improved, but not cured)	}	[3(25%)]
Recovery—Probing or irrigation	10 (32%) }	None
Recovery—Abscess incised or ruptured	2 (also probed)	3 (25%)
Refused necessary treatment	1 (3%)	1 (8%)
Major surgery of lacrimal sac necessary for recovery	None needed	6 (50%)
Average age at onset	1.5 months	4.5 years
Average age at first treatment	5.9 months	5.3 years

of symptoms, a number-two probe was passed one year later and the patient was discharged as cured two months after this second conservative probing. The nine patients who consented to a probing reported complete relief of symptoms in an average time of 3.5 weeks, five of the eight cases being without symptoms in one week. The tenth patient was irrigated five times in twelve months, and at the end of sixteen months was finally completely relieved. Probably one probing would have given him prompt relief. After probing, mercurochrome was passed, both for antisepsis and for indicating that the membrane was perforated.

I realize that the possibility of making a false passage is supposedly greater if the small probes are utilized, but if they are used with proper caution I believe that this risk is not great enough in these cases of congenital obstruction to outweigh the disadvantages from the use of larger probes.

Sharply differentiated from the picture just described is the series of twelve cases of acquired dacryostenosis with dacryocystitis which have several etiological factors: scarlet fever (four cases); trauma (three cases); upper respiratory infection (one case); bronchopneumonia (one case); foreign body in nose (one case); unknown nonsyphilitic origin (two cases). Nine of these twelve cases were right-sided, and only one bilateral case was seen. The average age of onset in these cases was 4.5 years. The average age at first treatment was 5.3 years.

The therapeutic results in these acquired cases can be stated briefly as follows: none of the patients have recovered under conservative treatment, involving the use of antiseptics and massage, but three have shown improvement; none of these twelve have recovered from probing or irrigation alone; three of them have recovered from acute phlegmon after incision or spontaneous rupture of an abscess; in six of the cases major surgery of the lacrimal sac was performed or advised.

The histories of the thirty-six children under observation have been condensed in the accompanying four tables.

Conclusions

1. It was necessary to wait 3.5 months before satisfactory results were obtained in the most persistent of the congenital cases under conservative treatment, while the average time required for recovery was 1.4 months. Therefore, it would be well to wait for three or four months before probing, if the case is under control, for in two thirds of the cases of congenital dacryostenosis treated by expectancy plus antiseptic solution and pressure over the sac, we have seen the duct open without further interference.

2. Probing, when necessary, can safely be performed satisfactorily with a number-two Bowman's probe without a canaliculotomy. The results with this simple procedure were uniformly satisfactory, and we see no reason for using larger probes in infants when conservative medical care plus conservative probing was effective in ninety-seven percent of our cases of congenital dacryostenosis.

3. Only fifty percent of our cases of acquired dacryostenosis were arrested by conservative and simple therapy. The other half have required or do require a dacryocystectomy or other major operation of the lacrimal drainage apparatus, thus showing a marked difference in comparison with the benign course of the great majority of congenital cases of dacryostenosis.

In closing, I wish to express my appreciation of the courtesy and cooperation shown me by Dr. Richard Gamble, head of the Department of Ophthalmology at Children's Memorial Hospital.

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THE MECHANISM OF EXPERIMENTAL EXOPHTHALMOS

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The experimental observations were confined to the dog. In this animal the entire orbital contents, with the exception of the lacrimal gland, are enclosed in a conical fascial sheath. The base of the cone surrounds the orbital margins in front and its apex is attached to the foramina at the posterior of the orbit. The superior surface of the sheath is composed of alternating layers of elastic and connective tissue, directly continuous with which are strands of smooth-muscle fibers.

Electrical stimulation of the cephalic end of the cut vagosympathetic trunk causes a circular contraction of the cone-shaped sheath, squeezing the eye forward into the position seen in exophthalmos. The action and independent contraction of the sheath have been carefully established. The importance of the conical sheath is illustrated by the fact that the surgical removal of a strip of the sheath establishes a chronic enophthalmos.
From the Department of Physiology and the Division of Experimental Medicine, The Mayo Foundation. Submitted for publication July 15, 1935.

Claude Bernard[1], in 1852, first reported that electrical stimulation of the distal end of the cut cervical sympathetic nerve of rabbits caused protrusion of the eye. Various muscles which by their contraction cause the eye to move forward have been described.

Shortly before his death H. Müller made two preliminary reports dealing with the smooth muscle of the orbit. The second publication[8], in 1859, dealt almost exclusively with the smooth muscle of the eyelids. In his earlier report (1858)[7], he stated that the inferior orbital fissure of man was closed by a grayish-red mass of tissue composed of bundles of smooth-muscle fibers, most of which possessed tendons of elastic tissue. In the lower mammals he found this structure to be a more developed membrane (membrana orbitalis or musculus orbitalis) composed of layers of elastic tissue and smooth-muscle fibers. Stimulation of the cervical sympathetic nerve caused contraction of the muscle and protrusion of the eye in animals observed by Müller. Because of the brevity of Müller's report it is difficult to ascertain his conception of the exact mechanism by which he believed this muscular tissue to have caused the eye to protrude.

The anatomic observations of Müller were extended in 1866 by Harling[2]. He described the membrana orbitalis as being composed chiefly of elastic and connective tissue, with a layer of smooth muscle fibers of varying thickness. In the dog he found this layer of smooth muscle to be in the shape of a longitudinal strip, the individual fibers of which ran circularly as well as longitudinally. In animals he regarded this muscular tissue as being antagonistic to the muscle, retractor oculi, and believed it to be innervated by the sphenopalatine ganglion.

MacCallum and Cornell[6], in 1904, described a smooth conical "mantel" about the eye of the dog which was continuous anteriorly with the musculature of the lids and formed abundant attachments about the margins of the orbit; from thence it passed backward to end about the optic foramen. They removed the top and side of the orbit and observed that, on stimulation of the cervical sympathetic nerve, a distinct peristaltic wave passed backward through the length of the cone, pressing the eye forward into the position seen in exophthalmos. They concluded that the ocular protrusion caused by stimulation of the cervical sympathetic nerve was due to the peristaltic contraction of the musculus orbitalis which pressed the eye forward.

In 1907, Landström[5] published the results of his histologic studies in which he examined the entire orbital contents by means of serial sections. He described a cylinder of smooth muscle, arising anteriorly from the septum orbitale, and inserted posteriorly just behind the equator of the eyeball. Landström regarded this cuff of smooth muscle as an antagonist to the four recti muscles and believed that it played a

principal role in the production of exophthalmos.

The mechanical action by means of which the various smooth-muscle structures described protrude the eye is by no means uniform. The mechanism of the fibers described by Müller is obscure. The action of the musculus orbitalis described by MacCallum and Cornell is one of constriction of a cone, pressing the eyeball forward. By virtue of its attachments, the smooth-muscle cylinder of Landström would protrude the eye by means of pulling it forward. The following research was undertaken with the aim of determining the mechanism of exophthalmos produced in the dog by stimulation of the cervical sympathetic nerve.

Anatomy

In the dog, only the medial wall and a portion of the roof of the orbit are composed of bone. The orbital contents of this animal may therefore be exposed without difficulty. Through a midline incision over the top of the skull, the temporalis muscle is reflected laterally from its origin. The masseter muscle is separated from the inner surface of the zygomatic arch and a section of that arch is removed. The coronoid

Fig. 1 (Code and Essex). Lateral view of the conical fascial sheath. The orbit opens on the face at an angle directed upward and forward. The inferior surface of the cone is distinctly longer than the upper surface.

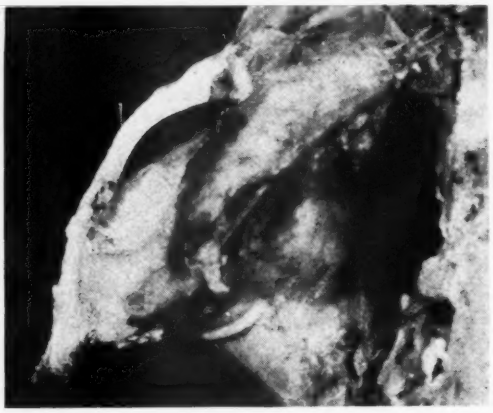

Fig. 2 (Code and Essex). Fascial conical sheath viewed from above. The zygomatic arch, frontal sinus, and a portion of the medial wall of the orbit have been removed. The long axis of the cone is directed medially and backward.

Fig. 3 (Code and Essex). Medial wall of right orbit. The zygomatic arch has been removed. Interrupted line indicates the bony attachments of fascial conical sheath to the crest, which marks the limit between the orbital cavity and the pterygopalatine fossa, and to the anterior margins of the orbit.

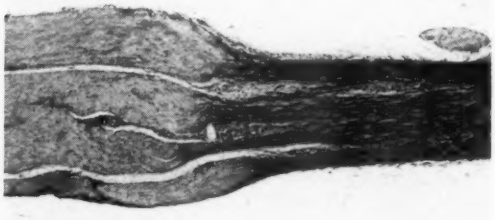

Fig. 4 (Code and Essex). Junction between the smooth muscle and elastic tissue portions of the conical fascial sheath. To the right are the alternating layers of elastic and connective tissue and to the left the smooth muscle. Weigert's elastic-tissue stain.

process of the mandible is clipped off and any remaining muscle fibers interfering with the exposure are divided. The stump of the coronoid process is lowered by separating the jaws and the lacrimal gland is cleared away. The frontal sinus is opened from above and a portion of the medial wall of the orbit is removed. It is important to maintain intact the anterior circumference of the orbit, which in the dog is not entirely encircled by bone but is completed above by the orbital ligament. Care must be taken to maintain the continuity of both the bony and the ligamentous portions. Finally, the surrounding fat is removed and the superior and lateral aspects of the orbital contents are brought clearly into view.

The foregoing procedure has repeatedly been carried out on the anesthetized animal. In addition more detailed dissections have been made. Dissections of the orbital contents of sixteen animals form the basis of this report. The following arrangement has been consistently observed: With the exception of the lacrimal gland, the entire orbital contents are enclosed in a common sheath. The shape of this sheath is roughly conical. Because of the obliquity with which the orbit opens on the face, the inferior surface of the cone is longer than the upper surface (fig. 1). The base of the fascial cone surrounds the orbital outlet in front and its apex the foramina at the posterior extremity of the orbit. The long axis of the cone is directed downward, backward, and medially (fig. 2).

The base of the fascial cone is attached firmly to the entire circumference of the orbital margin. In this region it becomes distinctly fibrinous. This is particularly noticeable along the bony portions of the orbital margin. Here it blends with the conjunctiva and the ligamentous structures supporting the eyeball. It seems, therefore, to be represented in man by that portion of the fascia bulbi which is reflected back over the extraocular muscles and which blends with their perimysium[9, 10].

Toward its apex, this fascial cone becomes less dense. It is attached in this region to the margins of the optic foramen, the foramen orbitale, and the foramen rotundum. About the foramen rotundum it becomes continuous with the fibrous sheath surrounding the maxillary nerve and internal maxillary artery. The extraocular muscles arise within the apex of the fascial cone, and thus a covering is formed for all the structures entering the posterior region of the orbit.

The lower border of the bony medial wall of the orbit is indicated on the skull by a distinct crest. This ridge of bone marks the limit between the orbital cavity and the pterygopalatine fossa. It commences posteriorly at the lower margins of the three foramina at the apex of the orbit, arches upward and forward, to end in a small prominence just above the entrance to the infraorbital canal. The fascial sheath of the orbital contents is attached to this bony ridge throughout its entire length (fig. 3). Along the medial wall of the orbit the sheath blends with the periosteum and gives a covering to the structures entering the ethmoidal foramen.

Cross sections of portions and of the entire circumference of the fascial sheath have been prepared for histologic examination. These have been stained with hematoxylin and eosin, with van Gieson's stain, and Weigert's elastic-tissue stain. It has been found that the superior surface of the cone is made up of alternating layers of elastic and connective tissue (fig. 4). It is possible that it was this strip of tissue which Harling regarded as smooth muscle. Continuous with the medial and lateral margins of the elastic and connective tissue are numerous bands of smooth muscle (fig. 4). The smooth-muscle fibers run for the most part in a circular direction. They course in a curved manner toward the bony attachments of the fascial cone. Except in the most anterior portion, however, the muscle fibers fail to reach the bone. They blend with fibrous and elastic connective tissue, and through it gain attachment to the medial bony ridge.

In specimens hardened in formalin for some weeks the structural differences in the fascial cone become evi-

dent macroscopically. The superior portion of elastic tissue is of the greatest width in the middle part of the cone. Particularly from its lateral margin, the muscle fibers radiate out in a fanlike manner. Owing to this arrangement, a somewhat oblique construction of the sheath is at times observed when on appropriate stimulation the smooth-muscle fibers contract.

Physiology

The orbital contents of a series of intact dogs have been exposed, following the procedure just described. The animals were anesthetized intravenously with sodium amytal, using approximately 50 mg. per kg. of body weight. Electrical stimulation of the central cut end of the vagosympathetic trunk in the neck invariably caused constriction of the orbital fascial cone. It was found that the action of the muscle was more apparent to the eye if maximal relaxation, with concomitant enophthalmos, was induced by preliminary section of the spinal cord in the lower cervical region. Our procedure was generally as follows: The vagosympathetic trunk was sectioned in the neck. The continuity of the spinal cord was interrupted, either by removal of the laminae of the sixth and seventh cervical vertebrae and division of the cord between ligatures, or exposure between the laminae of the seventh cervical and first thoracic vertebrae and strong ligation of the cord. Immediately thereafter, 200 to 300 c.c. of hypertonic fluid was administered intravenously. The orbital contents were then exposed.

Fig. 5 (Code and Essex). Isolated strip of fascial conical sheath perfused in oxygenated Ringer's solution. At signal, 15/100 c.c. of 1:1000 epinephrine was added to the perfusion fluid (40 c.c.).

Fig. 6 (Code and Essex). Changes in pressure within the fascial conical sheath on stimulation of the central end of the cut vagosympathetic trunk, recorded by means of a rubber balloon placed in the fascial cavity and connected with a piston recorder. P, is pressure within the balloon; S, is signal; and T, is time in divisions of five seconds. Blood pressure was recorded by cannulation of the common carotid artery, using a mercury manometer. At signal, the central end of the cut vagosympathetic trunk was stimulated.

Under such conditions, when the central end of the vagosympathetic trunk is stimulated, the circumference of the fascial cone is diminished and the eye is squeezed forward. The protrusion of the eye is facilitated by previous excision of the eyelids. In some animals a very marked exophthalmos was produced. The constriction of the cone is for the most part circular, although at times a distinct obliquity is noted. Following stimulation, the cone slowly relaxes and the eye sinks back into the orbit. Approximately seven minutes are required for the complete return of the

eye into the orbit. The stimulation may be repeated every ten to fifteen minutes for some hours.

The character of the contraction is interesting. It appears as a typical smooth-muscle response. There is a progressive constriction of the cone, as a whole, requiring some three to four seconds to reach its maximum. The eye quite gradually protrudes from the head, and then, on cessation of stimulation, very slowly returns to its previous position.

It might be stated that if the eye were pulled forward by a set of muscles such as has been described by Landström, the orbital contents would be drawn in behind the eye, giving the appearance of a contraction of the fascial sheath. This we have found does not occur. The following experiments have been carried out to demonstrate the contraction of the fascial sheath:

It has been demonstrated by MacCallum and Cornell that division of the cone in a circular fashion abolishes the effectiveness of sympathetic stimulation. We have found that if a longitudinal incision is made through the superior surface of the cone, vagosympathetic stimulation causes the edges of the incision to separate, the orbital fat bulges through, and the eye moves forward very slightly. When a circular flap of the fascia is raised and connected by its free margin with a lever, vagosympathetic stimulation causes shortening of the flap. Isolated circular strips of the cone perfused in oxygenated Ringer's solution contract on the addition of epinephrine to the perfusion fluid (fig. 5).

In four animals the following experiment has been carried out: Under anesthesia with sodium amytal, the orbital contents were exposed in the usual manner, an initial enophthalmos being induced by preliminary section of the spinal cord. Contraction of the fascial cone was observed with forward movement of the eye on vagosympathetic stimulation. The eye was then enucleated, care being taken to remove that portion of the fascia bulbi that immediately surrounds the posterior surface of the eyeball. A rubber balloon filled with water, but under no additional pressure, was then inserted into the cone. By means of sutures the orbit was closed in front and the balloon was connected to a piston pressure recorder. Vagosympathetic stimulation caused visible contraction of the cone and a rise of pressure in the balloon (fig. 6). In order further to determine whether that portion of the fascia bulbi which surrounds the posterior surface of the eyeball, usually referred to as Tenon's capsule, plays a part in the protrusion of the eye, microscopic sections of it have been prepared. We have been unable to demonstrate muscle fibers in this portion of the fascia.

If the tone or elasticity of the orbital sheath keeps the eye in its normal forward position, then removal of a portion of the cone should interfere with its action and cause the eyeball to become permanently sunken. The following operation has been carried out on two animals: Under ether anesthesia, and employing the usual surgical technique, the fascial sheath was exposed on one side. A wedge-shaped strip of the superior surface was removed with scissors. The base of the wedge measured more than 2 cm. in length. Both animals developed a chronic unilateral enophthalmos on the side of the operation. The appearance was accentuated by localized postoperative edema; but, after this had subsided, the sunken appearance of the eye was obvious even to the casual observer. The animals were observed for three months, and the unilateral enophthalmos was still present. It was noted during an acute experiment at the end of this period that vagosympathetic stimulation on the side of the operation caused only very slight forward movement of the eye, whereas on the other side the usual exophthalmos accompanied stimulation.

Following the technique as outlined by Labbé[4] and his associates[3], we have observed the effect of injection of ephedrine into dogs sensitized by repeated injections of thyroxin. We have confirmed their observation concerning the forward movement of the eye following the injection of this substance. During these experiments we exposed

the orbital contents and noted contraction of the fascial sheath. We believe, therefore, that the exophthalmos which follows the intravenous administration of ephedrine is produced by the same mechanism as that observed on vagosympathetic stimulation.

Comment

Our experiments confirm the observations of MacCallum and Cornell. It is probable that the fascial sheath just described is the structure which Müller briefly mentioned as the membrana orbitalis or the musculus orbitalis. In our experiments on the dog we have been unable to find evidence to support the mechanism of the production of exophthalmos suggested by Landström. Our observations allow us to conclude that the forward movement of the eye on sympathetic stimulation is due to the contraction of the smooth-muscle fibers present in the orbital fascial sheath (membrana orbitalis).

Summary and conclusions

Careful dissections of the orbital contents of dogs have been carried out. The attachments and histologic structure of the conical fascial sheath which encloses the orbital contents (membrana orbitalis), have been described.

Electrical stimulation of the central end of the cut vagosympathetic trunk causes circular contraction of the cone-shaped sheath, with forward movement of the eye. Smooth-muscle fibers are present in the cone-shaped sheath.

The action and independent contraction of the sheath has been established by the following observations: When a longitudinal incision is made through the superior surface of the cone, vagosympathetic stimulation causes separation of the edges of the incision, with very slight forward movement of the eye. A raised flap of the sheath shortens on vagosympathetic stimulation. Isolated strips of the cone perfused in oxygenated Ringer's solution contract on the addition of ephedrine to the perfusion fluid. When the eye is enucleated and replaced by a rubber balloon, vagosympathetic stimulation causes visible contraction of the cone and a rise of pressure in the balloon.

The action of the smooth-muscle fibers present in the cone-shaped sheath is such that by their contraction the eye is squeezed out of the orbit.

The surgical removal of a wedge-shaped strip of the conical sheath (membrana orbitalis) produces chronic enophthalmos.

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SYPHILIS AND PRIMARY GLAUCOMA

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A study was made of the incidence of syphilis in a group of 365 consecutive public-ward patients with primary glaucoma admitted to the Johns Hopkins Hospital between October, 1925, and February 1934, to establish if there is any basis, on clinical grounds, for the entity "primary syphilitic glaucoma," variously reported in the literature. No relationship between syphilis and primary glaucoma was suggested by a comparative study, with various control groups, from the point of view of incidence, age of onset, and response to specific therapy. A review of the manifestations of syphilis in patients with syphilis and primary glaucoma showed the luetic process to be latent in 82 percent of the cases. A study of 11 cases of buphthalmos did not point to an etiological connection with syphilis. From the Department of Medicine and the Department of Ophthalmology of the Johns Hopkins University.

The question of an etiological relationship of syphilis to primary glaucoma is one which has received attention in the past, but the published studies on the subject are so few in number that it seemed desirable to study the case material available in the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital, in order to determine if such a study would throw light upon the subject.

History

Pflueger[1] was the first to suggest a relationship between glaucoma and syphilis. At the International Ophthalmological Congress, in 1888, he stated his belief that there was an indubitable connection between the two. This belief he based on favorable results he had obtained by antisyphilitic treatment (mercury inunctions) in glaucomatous patients whose symptoms had not yielded to ordinary treatment. He was immediately supported by Wiecherkiewicz[2] and Waldhauer[3] who, independently, had made the same observation. Following this pronouncement numerous endeavors were made to establish "glaucoma syphiliticum" as a definite entity. Alexander[4], in 1895, came to the conclusion that "there can be no further doubt as to the occurrence of a syphilitic glaucoma, apart from the usual secondary glaucoma." Elschnig[6], in speaking of primary glaucoma, said that "not a small percentage may be caused by syphilitic vascular disease," and as late as 1931 Mazal[6] discussed "primary luetic glaucoma" as a definitely established entity. However, in a survey of the literature it becomes apparent that most of these assertions are made on the basis of isolated case reports all of which seem open to criticism. Of the authors who have reported more than one or two cases (Koritny[7], Charlin[8], Carlotti[9], Arnoux[10], Luque[11]) none has made the necessary clear distinction between primary and secondary glaucoma. Obviously, there need be no further discussion of the etiology of a glaucoma which has followed in the train of a syphilitic infection of the uveal tract. Such a glaucoma is plainly secondary to an antecedent inflammatory process.

However, when we are dealing with a primary glaucoma in a syphilitic patient, the matter assumes an entirely different aspect. While simultaneous occurrence of the two conditions in the same individual may be of significance, it is not justifiable to assume an etiological relationship between the two for this reason alone. Also, the high percentage of syphilis in glaucoma cases reported by both Charlin[8] and Luque[11] from the Hospital del Salvador at Santiago de Chile, may be of no significance whatever, since such an increased percentage might well be dependent upon a high incidence of syphilis in their general hospital population. This possibility both authors have failed to consider. Therefore, Charlin's assertion that "every glaucoma patient under 50 is very probably a syphilitic" does not carry weight. In many of the reported cases the evidence of a coexisting syphilitic infection is not convincing. Statements that the patient was "probably syphilitic," "highly suspicious," or had "chronic aortitis" are not satisfactory

evidence of the existence of syphilis. Also, routine serological tests are not usually done in patients with glaucoma. Igersheimer[12] well states that the decision as to any possible etiological relationship between primary glaucoma and syphilis can be reached only after systematic investigation. We have therefore studied our cases of primary glaucoma, seeking to ascertain if there be any basis, on clinical grounds, for the entity "glaucoma syphiliticum."

The problem

In seeking to determine the possible relationship between syphilis and primary glaucoma, the problem essentially is: 1. to compare the incidence of syphilis in a group of glaucoma patients with its incidence in a similar group of patients presenting a different kind of eye lesion, which occurs, however, at about the same age and in which syphilis is known not to play any etiological rôle (for instance, cataract); and 2. to compare the effect of antisyphilitic plus "routine glaucoma treatment" in a group of cases of primary glaucoma and syphilis, with the effect of "routine glaucoma treatment" only in a control group of patients with glaucoma but without syphilis.

Methods of study and material

The material available for study consisted of 365 consecutive cases of primary glaucoma, representing all the primary glaucomas admitted between October, 1925, and February, 1934, to the public wards of the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital. All of these patients had Wassermann tests done routinely and received a general physical examination. Those with a repeatedly positive Wassermann reaction were referred to the Syphilis Clinic for study from the standpoint of syphilis. Both whites and negroes are represented in this report, corresponding to the general hospital population of this locality. On account of the much higher incidence of syphilis in the colored race, consideration must be given to that fact in the comparison of data.

In this analysis the following points have been considered: (1) a comparison of the incidence of syphilis in patients suffering from primary glaucoma with the incidence of syphilis in a control group of patients with senile cataract; (2) a study of the manifestations of syphilis in the syphilitic glaucomatous patients; (3) a comparison of the age of onset of primary glaucoma in the syphilitic group with that in the nonsyphilitic group; (4) the therapeutic response in glaucomatous patients with syphilis who have received antisyphilitic therapy *in addition to* the usual measures employed in treating primary glaucoma, contrasted with the results obtained in the nonsyphilitic group by the usual measures alone.

The criteria employed for the diagnosis of syphilis were: (a) definite history, or (b) signs of syphilis on physical examination, or (c) repeatedly positive Wassermann tests.

Incidence of syphilis in primary glaucoma

Table 1 shows that in the *white* group one finds more syphilis in the cataract category than in the primary-glaucoma column, the incidence being 2.8 percent and 2.1 percent, respectively. In the *colored* group, there is a considerably greater occurrence of syphilis in the patients with primary glaucoma than in those with cataracts. However, in all these patients the incidence of syphilis is lower than in a large group of successive admissions to the general medical wards of the Johns Hopkins Hospital, as reported by Keidel and Moore[13]. The criterion of their study was the positive Wassermann reaction, and their values are therefore below the actual incidence of syphilis, but even without taking this factor into account, it becomes evident that as far as the incidence of syphilis is concerned, there is nothing in this phase of the study that points to an etiological relationship between primary glaucoma and syphilis.

In almost all of the glaucomatous syphilitic patients, the diagnosis of syphilis was made on the basis of the Wassermann reaction alone. In a total of 343 patients with primary glaucoma and a *negative* Wassermann, only 2 gave

a clear-cut history of syphilis. Both had had their infection more than 10 years previously and had received continuous antisyphilitic treatment for more than a year. In the cataract control group, out of a total of 343 patients with a appear at an earlier age. This point has also been considered in the present study, the age of the onset of the glaucoma symptoms having been contrasted in the syphilitic glaucomatous patients and in the nonsyphilitic glaucomatous.

Table 1

INCIDENCE OF SYPHILIS IN PATIENTS WITH PRIMARY GLAUCOMA AND WITH CATARACT

		Primary Glaucoma	Cataract	General Medical Admissions (Keidel and Moore)
Total no. of patients	White	288	288	2726
	Colored	77	77	2010
Number of patients with syphilis	White	6	8	209
	Colored	16	12	461
Percentage incidence of syphilis	White	2.1	2.8	7.6
	Colored	20.9	15.6	22.9

negative Wassermann, 3 gave a positive history of syphilis, and 2 of these had received adequate treatment, but there was no case in this group that showed signs of syphilis on examination.

Manifestations of syphilis in syphilitic patients with primary glaucoma

Of the 22 patients with primary glaucoma and syphilis, only one showed severe organic involvement, namely, cardiovascular syphilis, verified later by autopsy; 2 patients had asymptomatic neurosyphilis, and in another, cardiovascular syphilis was tentatively diagnosed. The remaining 18 patients (82 percent of the total) were latent syphilitics.

Comparison of the age of onset of primary glaucoma in the syphilitic and nonsyphilitic groups

It is conceivable that if syphilis can cause primary glaucoma, it might have the effect of causing the glaucoma to

We see from table 2 that as far as the difference in age between the two categories is concerned, there is none in the colored group, and the white patients with primary glaucoma and syphilis were on the average three years older when their glaucoma symptoms set in than were the nonsyphilitics. From this standpoint, then, there is no evidence tending to show that there is an etiological relation between syphilis and primary glaucoma.

Therapeutic response of syphilitic patients who have received antisyphilitic therapy in addition to the usual measures, contrasted with results in the nonsyphilitic group

The response of syphilitic glaucomatous patients to antisyphilitic treatment should *a priori* afford the most convincing evidence for or against an etiological relationship between syphilis and primary glaucoma. The ideal mode of approach would be to withhold entirely

Table 2

AVERAGE AGE IN PATIENTS WITH PRIMARY GLAUCOMA

Race	No. of Patients		Average Age (years)	
	Syphilitic	Nonsyphilitic	Syphilitic	Nonsyphilitic
White	6	282	61	58
Colored	16	61	51	52

treatment by miotics and to administer antisyphilitic treatment alone. In actual practice, however, it is not possible so to restrict the treatment of the syphilitic glaucomatous patients; they must still continue to receive the benefit of miotics. One must therefore be satisfied to study the syphilitic glaucomatous patients who have received the routine glaucoma treatment combined with specific therapy against syphilis. If the effect of the antiluetic drugs were very striking, it would doubtless show even under these conditions.

Table 3
ANTISYPHILITIC TREATMENT

Therapy	Number of Cases
Little arsenic, little heavy metal	12
Little arsenic, much heavy metal	1
Much arsenic, little heavy metal	1
Much arsenic, much heavy metal	3

("Little" signifies less than 20 injections, and "Much" more than 20 injections)

Of the 22 patients with primary glaucoma and syphilis, 17 were treated for both syphilis and primary glaucoma. The amount of antisyphilitic treatment received is given in table 3, in which the terminology used in the "Cooperative clinical studies in the treatment of syphilis"[14] has been employed.

The average period of observation of these cases was 14 months. The control series of nonsyphilitic patients with primary glaucoma available for comparison consisted of 52 consecutive cases, which, on the average, were observed for a period of 27 months. While the patients also had various perimetric measurements, in all of them the treatment was governed chiefly by the course of the intraocular tension. The status of the tension, expressed in table 4 as "satisfactory" or "not satisfactory" signifies the decision of the examining ophthalmologist after manual or tonometric measurements or both.

A glance at table 4 shows that of the 17 syphilitic cases treated at some time after the onset of symptoms with antisyphilitic drugs, not one showed a gratifying response. In 11 of the 17 cases antisyphilitic therapy was begun soon after the patient presented himself, and in one it had been started 8½ months before. But in all these patients local treatment plus antiluetic therapy failed to control the disease, and an operation was finally performed. One of the 17 cases deserves special mention because of the recurrence of glaucoma symptoms in spite of prolonged antisyphilitic treatment. The patient received continuous antiluetic treatment for 2½ years following his operation, the intraocular tension remaining normal all the time. Six months after cessation of the specific treatment uveitis set in followed by secondary glaucoma.

The number of treated syphilitic glaucomatous patients in this series is too small to warrant our drawing sweeping conclusions. As far as they go, the results of antisyphilitic treatment in this group indicate that a small amount of such treatment is not effective in combating the glaucomatous condition. Whether or not a large series of patients treated with antisyphilitic drugs over a long period of time would produce different results it is impossible to say. Our observations, then, limited as they are, lend no support to the view that syphilis can cause primary glaucoma.

Table 4
EFFECT OF TREATMENT

Mode of Treatment	Response Satisfactory	Response Not Satisfactory
Antisyphilitic treatment plus pilocarpine (17 cases)	None	100%
Pilocarpine alone (in nonsyphilitics; 52 cases)	14%	86%

Syphilis and buphthalmos

The possible relationship between syphilis and buphthalmos may be briefly considered. Only very occasional mention is made of this in the literature. However, from a review of 47 cases of glaucoma in persons whose eyes were abnormal from birth, Seefelder[15] con-

cludes that congenital syphilis cannot be thought to play a role in the pathogenesis of buphthalmos.

Of the 11 patients with buphthalmos who had a Wassermann taken while in the Wilmer Ophthalmological Institute, none had any stigmata of congenital syphilis and only one had a positive Wassermann. That particular individual was a 17-year-old white girl in whom the consulting syphilologist found no signs of congenital syphilis. These data would not therefore lead us to change our conception that buphthalmos and syphilis are in no way related.

Summary

1. A statistical study has been made of the incidence of syphilis in a group of 288 white patients and 77 colored patients with primary glaucoma, representing all the public-ward patients with primary glaucoma admitted to the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital between October, 1925, and February, 1934.

2. The incidence of syphilis in primary glaucoma has been compared with the incidence of the same disease in cataract, another common eye disorder occurring at about the same age period as does glaucoma and known to be in no way related to syphilis. In the *white* patients the incidence of syphilis was found to be somewhat lower in those with primary glaucoma than in those with cataract, and considerably lower than in a series of general medical admissions. In the *colored* group the incidence of syphilis was higher in those with primary glaucoma than in those with cataract, but still lower than in the general medical admissions.

3. A comparison of the average age of the patients at the onset of glaucoma symptoms in the syphilitic and the nonsyphilitic groups showed that the white syphilitics were 3 years older than the nonsyphilitics when their glaucomatous symptoms appear, while in the colored patients there was no difference between the two groups.

4. Of the 22 patients with primary glaucoma and syphilis, the syphilitic disease process was latent in 18 (82 percent). One patient had cardiovascular syphilis verified by autopsy, and 2 had asymptomatic neurosyphilis, while in a fourth, cardiovascular syphilis was tentatively diagnosed.

5. A comparison of 17 syphilitic cases treated by specific therapy and miotics and observed for an average of 14 months with a series of 52 nonsyphilitic cases treated by miotics alone and adequately followed, showed a somewhat poorer therapeutic response in the syphilitic group.

Conclusion

This study has failed to present any evidence for the view that primary glaucoma is in any way related to syphilis.

The author wishes to express his thanks to Dr. William Holland Wilmer for the privilege of using the records of the Wilmer Ophthalmological Institute.

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VOLUNTARY CONTROL OF ACCOMMODATION

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PHILADELPHIA

Two cases are reported in which the patients could voluntarily bring accommodation into action while looking at distant objects.

In the first case there is apparently a tendency to spasm of accommodation in infinity accompanied by excessive convergence, though the possibility of the reverse sequence cannot be entirely excluded; that is, the primary anomaly is a convergence excess accompanied by excessive innervation of accommodation.

In the second case there is a subnormal accommodation impulse as well as a controlled accommodation. The existence of a high exophoria for near with the refraction error corrected is due to lack of innervation of the interni as a result of the relaxation of accommodation. The esotropia present without correction of the hyperopia is the ordinary accommodation squint. Read before the Section on Ophthalmology of the College of Physicians of Philadelphia, April 18, 1935.

The two cases here recorded are unique in my experience, yet they were both seen within a year's time.

Case 1. J. S. H., male, aged 25 years, art student, was referred to me by Dr. F. R. van Istendal. The history is compiled from my own and Dr. C. A. Patten's carefully recorded notes. The patient's mother has a substernal goitre. In his early years the patient was healthy except for some of the usual diseases of childhood. At the age of ten he had an excessive deposit of fat about the waist. Puberty was late. His tonsils were removed at the age of 14. He described himself as an overconscientious, hypersensitive individual, being meticulous in everything he did. In childhood he was left-handed and wrote and drew upside down with either hand. As Dr. Patten put it "there was some difficulty in establishing right or left cerebral dominance."

Since childhood he at times has had blurring of vision. Now his eyes quickly become fatigued, but he has little difficulty until in the afternoon, when he is obliged to strain in order to see. As a result vision becomes greatly blurred and distant objects are doubled.

Perhaps a clearer idea of the patient's ocular troubles would be obtained by giving his own intelligent account of them:

"I can see clearly any distant object and also the smallest of print. I can also distort my vision both for distance and reading so that no distant object is clearly defined and no print is legible. Only masses of color remain. I have double vision along with the distortion. In distant vision I can see clearly for some time and at any time I wish, with no effort, I can blur my vision, keep it blurred as long as I wish, and bring back clear vision without any strain or effort.

"In reading the opposite occurs. I have to strain with great effort to see clearly, for the tendency is toward a blurred condition. Thus it is in reading that I am affected most. Although I can bring print clear and blur it at any time, the tendency toward blurred vision is usual after an hour's reading, and the effort to bring back clear print is greater as the length of the reading time increases.

"I have noticed this condition ever since I can remember, with the exception of double vision, which occurred only a few years ago. It affects me physically in that I become quite sleepy, yet on closing my eyes I am as wide awake as ever. Concentration becomes difficult, eyes become bloodshot, and black spots appear. The eyes also feel swollen and seem to be under a

constant strain. The main point is that while my eyes are blurred I feel perfectly comfortable; that is, there is no strain. Thus it is this point that makes me say they are relaxed when blurred for I feel the muscles must be relaxed.

"The clearest way in which I can describe the blurred condition is that it is similar to the focusing of a movie projector. The same distortion of objects exists on the screen when the projector is improperly focused."

He had sought relief from several oculists but with little help. Recently orthoptic training by a physician and by a procedure of his own had been helpful. For the past four years he had worn before each eye a +1.25 D. sph. ⌯ +0.25 D. cyl. ax. 90°. Vision without glasses, and accommodation relaxed, was O.D. 6/7½, O.S. 6/9; with glasses, both eyes uncovered, 6/5 part. With accommodation in spasm he had only finite vision. In each eye ppa. for type 0.37 was 8 cm. Without glasses, and accommodation relaxed, esophoria = 2½ degrees for distance and exophoria = 2 degrees for near. In spasm for distance there was diplopia; images fused by 30-degree prism, base out.

Under homatropine cycloplegia the refraction error was:

O.D. +1.50 D. sph. ⌯ +0.25 D. cyl. ax. 90°. 6/5.
O.S. +1.25 D. sph. ⌯ +0.25 D. cyl. ax. 90°. 6/5.
Orthophoria for distance.

Postcycloplegic. With a —5.50 D. added to the full correction, with accommodation in spasm, vision was 6/6 part, with micropsia. With either eye fixing and accommodation in spasm the screened eye was converged about 15 degrees. With accommodation relaxed the eyes were stationary under cover. In diffuse light the pupils were rather large, equal, and reacted normally. He had full binocular vision, though with the Verhoeff cerebral test fusion was delayed. When the accommodation was in spasm, and the correcting glasses were on, it required a —3.00 D. sph. lens in the ophthalmoscope to see the fundus details. With the biomicroscope, when the patient voluntarily accommodated for distance the change in the curvature of the lens accompanying the accommodative act could be seen. This was confirmed by Dr. Alfred Cowan.

The fields of vision showed none of the changes which we associate with neurasthenia or hysteria.

Because of the convergence excess when the accommodation was in spasm it was thought that if this could be relieved it might lessen the tendency to voluntary action of the accommodation. The distance correction less 0.25 D. sph., combined with a 1½-degree prism, base out, before each eye, was prescribed. Two weeks later the patient reported that the tendency to blurred vision and diplopia was greatly lessened and his capacity for work greatly increased.

He was sent to Dr. Patten to have a psychological study made. The neurological examination was entirely negative. The diagnosis was (1) Hereditary endocrine disturbance; (2) Psychoneurosis of the anxiety neurosis type.

At a recent examination, vision in each eye was 6/4 part. There was orthophoria for distance. Esophoria 2 degrees for near. With both eyes he read type 0.37, with a ppa. of 10 cm. This with the accommodation in spasm, which is about 1.5 D. above the average for the age period.

Case 2. S. Y., aged 14 years, female, was first seen on August 22, 1933. For the previous 20 months she had complained of inability to see to read without straining. The left eye had turned in since she was 20 months old, and she had worn glasses since that time. The last change was made two-and-a-half years ago under cycloplegia. She was wearing:

O.D. + 3.00 D. sph. ⌯ +0.75 D. cyl. ax. 75°.
O.S. +3.50 D. sph. ⌯ +2.00 D. cyl. ax. 105°.

Vision in the right eye without glasses was 6/9 part, with glasses 6/7; in the left eye without glasses 6/22, with glasses 6/9 part. Without glasses esophoria was 3 degrees for distance and 10 degrees for near, the right eye fixing. Bar reading was impossible and

rotations were full; but in rotation to the right the left eye turned slightly up. The media were clear. There was a pseudoneuritis and a hyperopia of 6 to 7 D. The fields gave no indication of hysteria or of neurasthenia.

Under atropine the refraction error was:

O.D. +5.25 D. sph. ⊂⊃ +1.00 D. cyl. ax. 60°. 6/4 (2 mistakes).
O.S. +4.75 D. sph. ⊂⊃ +2.50 D. cyl. ax. 30°. 6/6 part.
Esotropia = 2 degrees.

Postcycloplegic. All but 0.75 D. in each eye was manifested. With both eyes all but 0.25 D. was manifested. With this glass esotropia = 3 degrees for distance, exophoria = 12 degrees for near, L.H. = 2½ degrees. Type 0.37 was read, with a ppa. of 9 cm. Prism adduction was nil. Because of the exophoria for near 1.25 D. less than full was prescribed. Fusion was absent.

Two months later the patient returned complaining of inability to read without conscious effort. At no time had the glasses been satisfactory for reading. Because the exophoria had increased to 17 degrees her trouble was attributed to this and the sphere was further reduced I D. This only increased her difficulty and it was then first realized that the trouble was that unless she made a conscious effort the accommodation relaxed. When relaxed and with full correction on she was able to read no type smaller than 1.50, with a ppa. of 53 cm. With the accommodation active it was possible to read type 0.37, ppa. 10 cm. With +2.50 added to the full correction and accommodation relaxed, type 0.37 was read, ppa. 16 cm. Two months later there was practically no change in the visual function but the new glasses had given considerable relief.

In restudying the eyes recently it was found that the patient could relax the accommodation for distance so that all the hyperopia for distance became manifest, and without glasses vision in each eyes was 1/60. With full correction, vision in the right eye was 6/4 and in the left 6/6. With the same glass and the left eye screened and adducted, vision in the right eye was 6/9, with —3.00 6/4. With the right eye screened and adducted, vision in the left eye was 6/22, with a —3.00 6/6. (This observation is questionable.)

With the distance glass and accommodation relaxed, type 1.50 could be read. With +3.00 added and accommodation relaxed, type 0.37 was read, ppa. 9 cm.

In the first case there is apparently a tendency to spasm of accommodation in infinity accompanied by excessive convergence, though the possibility of the reverse sequence cannot be entirely excluded; that is, that the primary anomaly is a convergence excess accompanied by excessive innervation of accommodation.

In the second case there is a subnormal accommodation impulse as well as a controlled accommodation. The existence of a high exophoria for near with the refraction error is due to lack of innervation of the interni as a result of the relaxation of accommodation. The esotropia present without correction of the hyperopia is the ordinary accommodation squint.

In both cases the patients were advised to have a thorough physical examination, with special attention to the teeth because of the possibility of reflex disturbance.

If apparent discrepancies are noted in the details of these cases it should be remembered that we were dealing with a physical function which is necessarily variable, and as the tests were in part subjective it was difficult for the examiner to exercise a control.

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THE RECESSION OPERATION—A CRITICISM

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Criticism of Jameson's operation is directed toward the unnecessary hazards to which, in the opinion of the author, both the function and the eye itself are exposed. He advocates in its stead his own two-stage tenotomy and subcapsular tenotomy, properly combined with cinch shortening. Read before the Western Ophthalmological Society, Portland, Oregon, May 20-23, 1935.

As an introductory statement to the development of my thesis, I wish it to be clearly understood that this is a criticism of an operation and not of its originators nor of those who use it. The object of this paper is to argue the truth of the following beliefs of the writer: 1. A patient is entitled to the safest operative work that will give the desired result. 2. Muscle surgery is in the category of those procedures that do not warrant the taking of unnecessary risks as to either muscle action or the globe itself. 3. The recession operation is risky in two respects: (a) Muscular mechanics and functions are unduly altered. (b) Scleral sutures have caused loss of the eye itself. 4. Operative methods are available that secure the desired results without these risks.

The following quotation from a paper by Dr. J. M. Wheeler is à propos: "Here the principle I want to emphasize is that of simplification of technic. Sutures should not be passed through eye structures unnecessarily and surgical measures should never be complicated if they can be kept simple. They should never be difficult if they can be kept easy."

Dr. Jameson, who has popularized the recession operation, expresses the following opinions: 1. That a re-set to the equator is permissible. (This means about 6 mm.) 2. That extensive lateral capsular cuts are necessary to permit the tendon to drop back as far as that. (This, to my mind, is an indirect way of stating that an ordinary complete tenotomy does not give enough set-back. How then can the greater set-back of a recession cause less restriction of function than the lesser set-back of a tenotomy?) 3. That scleral sutures are safe and can be properly placed in *all* cases. (When one recalls that the sclera is only four to five tenths of a millimeter thick at the equator—and this in adults—it becomes evident that a great deal of skill would be required to split it with 100-percent consistency. The thinness of the sclera in children calls for even greater accuracy.) 4. That catgut-suture material is also 100 percent safe, and that his "ligated suture" is the best. (Many operators, general and ophthalmic, do not have this confidence in catgut. The two ligated sutures, if I interpret his drawing correctly, leave eight square knots of catgut buried. This makes a rather large amount of catgut to be digested and absorbed. Absorption is especially slow in this region, as I learned when using catgut in my cinch operation, in which there were no knots and in which therefore a much smaller amount of gut was employed. Frequently even triple 0 chromic had to be removed because of irritation and failure of absorption.)

Dr. Curdy, some years before Jameson, proposed a recession which, to me, seems safer in the following respects: 1. The maximum set-back is 4 mm. 2. Lateral capsular cuts are not made. 3. Scleral sutures are of fine silk tied on the conjunctival surface, thus permitting their removal. Dr. Curdy admits that the placing of these sutures "is not free from risk to the integrity of the eye." To me it seems self-evident that if a muscle works best with its insertion 6 mm. from the cornea, it cannot do so with one 12 mm. back—at the equator. The following case history is most interesting.

Dr. W. had a simple tenotomy of the left internus done in 1921, for an esophoria of 10 degrees. In 1932, the left externus was tucked. In February, 1933, the right internus was "recessed 3 mm." When he came to me he was wearing a pair of 6-degree prisms to prevent diplopia, and his esophoria was 22 de-

grees. In spite of this he could converge only to 6 inches. Inward rotation of the right eye (recession) was only 25 degrees, while that of the left (tenotomy) was 45. I shortened the right externus by the cinch method, securing lateral orthophoria. In as much as he was an emmetrope the freedom from his heavy prisms was a "joy," and he became a most happy patient after thirteen years of "misery." His case affords a wonderful opportunity to compare the results from four different types of operations. It should be noted that a 3-mm. recession caused more interference with function than a simple complete tenotomy. I am confident that I could have secured the desired result with cinch shortenings and central tenotomies with no loss of convergence or of inward rotation.

It has been generally accepted that an increase in the contact arc will increase the leverage to rotate the eye. If this is true, can it not be assumed that a decrease in this arc (recession) will have the opposite effect? An insertion set at the equator (recession) has no contact arc whatever. An internus so set on rotating the eye reaches a straight-line pull from origin to the new insertion before the normal limit of inward rotation is reached. The closer this line of pull approaches "the shortest distance between two points" (straight pull) the less is its leverage for rotating, and it cannot go beyond that line.

Another important point mentioned by Curdy is that the formation of adhesions behind the point of scleral fixation brings about a greater recession, because the point of action is from the rearmost adhesion.

How then can interference with conjugate action be avoided or anything but a noncomitant condition be produced? It is inconceivable that conjugate impulses to muscles with such large insertional differences can result in parallel action. When we hope to secure or retain binocular vision, normal conjugate action must be preserved.

Therefore it would follow that recession is in order only in useless eyes with more or less contracture in the muscle to be set back. But not even in these is it necessary. Beard expressed the same opinion in his "Surgery," concerning operations that give results similar to those of recession. I feel that the muscular portion, when set back, must develop contractures due to lessening of the normal elongation when the eye rotates in the opposite direction, as well as to the fact that, in the primary position, its total length is reduced by the amount of the recession. In ordinary cases of strabismus the lateral rotations are not reduced. If an internus, capable of relaxing to an outward position of 50 degrees, is set back 6 mm., just that much extension becomes unnecessary and the muscle would have a tendency to become permanently shortened by that amount. For these reasons, in addition to others mentioned, I feel that the operation is applicable only in cases in which these contractures have already developed. But, as stated before, even in these it is not necessary.

I have operated four times for divergence secondary to recession and in each case have measured the set-back with Walker's scleral ruler. All had marked reduction of inward rotation and, of course, impaired or no convergence. One had two mm., two had three mm., and one had four mm. of set-back. All therefore were well within Jameson's allowable limit and yet in all there was marked interference with binocular and monocular action. In each instance a cinch shortening of the re-set tendon gave satisfactory cosmetic results and a large increase in inward motion.

The only reason for scleral-fixation sutures is the common idea that a cut tendon frequently fails to re-unite with the globe. I know that this is not true because I have operated in many cases of secondary divergence and in only one was the tendon not re-attached. Moreover in my two-stage tenotomy the central portion is always firmly attached when the marginal cuts are made six weeks later. Re-attachment is certain if the tenotomy is done as a subcapsular operation through an incision parallel to the tendon fibers, because the overlying capsule and conjunctiva

hold it in close contact with the globe.

From personal experience in many operations I know that a subcapsular tenotomy limited strictly to the tendon proper and made by extending a central buttonhole does not appreciably reduce either inward rotation or convergence. The day this is being written I removed the shorteners from the externus of an eye operated on 14 days ago. Its internus had been so cut. Already it has re-attached firmly enough to give inward rotation to cross the nasal bridge.

The general principle in muscle surgery is so to perform each operation that no mechanical harm will result and to correct the original causal condition. This was emphasized long ago by Stevens. It means that a tenotomy of the left inferior oblique for hyperphoria due to paresis of the right superior rectus is wrong. And yet many authorities advise just this procedure. It is much safer to multiply operations, on different muscles of the involved group, leading up to the final desired result, than to risk doing harm in the attempt to secure a full effect by one operation at one place.

When one criticises anything these days he usually brings forth a silly remark to the effect that criticism is out of order unless something better can be proposed. As though an idea is right merely because of an absence of knowledge of something better! However, I am sure that my two-stage tenotomy and the subcapsular tenotomy (in some cases) when properly combined with a cinch shortening will give the desired results with the least risk to the eye and its functions. Those who do not use the cinch operation properly have no idea of what can be done, in safety, with all kinds of muscle imbalances.

In conclusion I wish to quote the opinion of a friend who has charge of a large clinic: "Everybody here except yours truly has gone daffy over recession and already I notice divergence here and there and have corrected two or three in the last six months. I predict that the recession will be a thing of the past within the next two years and we will all be busy picking up the wandering muscles and bringing them back home." I am afraid he is too optimistic, but I hope this paper will help toward the end he predicts.

450 Sutter Street.

THE DISSOCIATIVE INFLUENCE OF THE NORMAL RABBIT CONJUNCTIVA ON BETA HEMOLYTIC STREPTOCOCCI

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Experiments were performed to determine whether the conjunctiva would exert a dissociative influence on bacteria. The normal rabbit was employed as the experimental animal and three different strains of Streptococcus haemolyticus were used as test organisms. After the bacteria had remained in contact with the rabbit conjunctiva for varying intervals, the organisms employed exhibited loss of hemolytic quality, loss of pathogenicity, and changes in colony and cell morphology. Since such changes are accompanied by loss of virulence, possibly this dissociative influence by the conjunctiva may be one of the defense mechanisms of the eye against bacterial invasion. From the Department of Bacteriology and Preventive Medicine, University of Illinois College of Medicine, Research Laboratories of the State Department of Public Health and The Chicago Medical School.

A previous report[1] presented evidence that the phenomenon of bacterial dissociation is continually in progress on the skin areas around the eye. The accumulated data suggested a direct relation between the degree of S to R mutation and the ability of the skin to resist ordinary inflammatory conditions. As a logical sequence to this work it was thought that the conjunctiva itself should be investigated for the purpose of determining whether it also possessed the power of bringing about a similar dissociative attenuation of bacteria. With this in view, the following experiments were performed.

Experiments

The site selected for experimentation was the conjunctival sac of the normal rabbit. The rabbit was purposely chosen for this work because the conjunctival sac is of good size, the cornea is not sensitive, and the nictitating mechanism is relatively inactive. It has been observed that rabbits under ordinary conditions keep their eyes open, and that no appreciable movement of the lids or nictitating membrane may occur for as long an interval as one hour, which met the needs for our experiments. The fact that nictitation is a means of conjunctival contamination has been shown previously[2], and therefore the selection of an animal in which this mechanism would be inactive was imperative.

The procedure in procuring and maintaining a sterile field in the conjunctival sac was as follows: The rabbit was placed in a restraining box in a

Table 1

Streptococcus haemolyticus
(Scarlet Fever Strain)

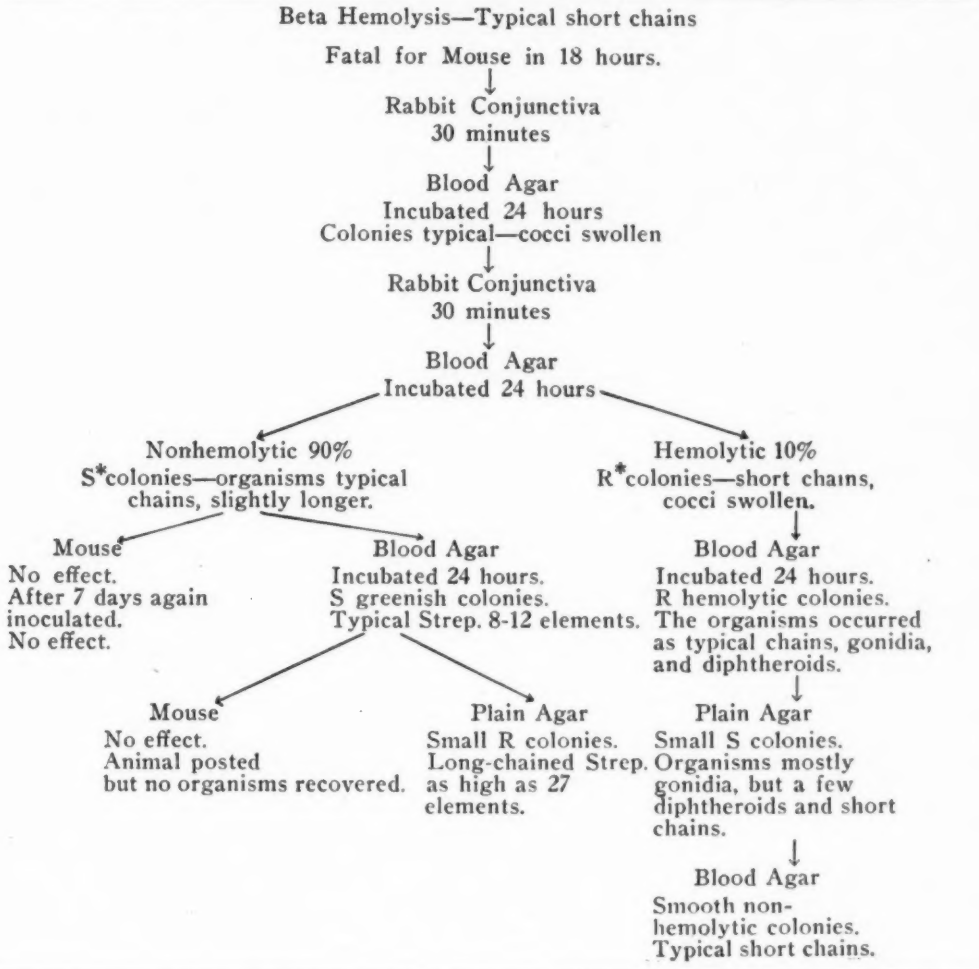
Time	No. of Colonies	Type of Hemolysis*	
1 minute	5000	Beta	
5 minutes	460	Alpha prime	
10 minutes	342	Beta	23
		Alpha prime	159
		Gamma	159
15 minutes	272	Beta	0
		Alpha prime	95
		Gamma	177
20 minutes	108	Beta	0
		Alpha prime	65
		Gamma	43
25 minutes	86	Beta	0
		Alpha prime	43
		Gamma	43
30 minutes	107	Beta	12
		Alpha prime	50
		Gamma	45
35 minutes	67	Beta	6
		Alpha prime	3
		Gamma	58
45 minutes	98	Beta	0
		Alpha prime	49
		Gamma	49
50 minutes	264	Beta	0
		Alpha prime	14
		Gamma	250
55 minutes	31	Beta	0
		Alpha prime	0
		Gamma	31
60 minutes	107	Beta	0
		Alpha prime	19
		Gamma	88

* The Brown classification of streptococci based on the appearance of the colonies on blood agar is employed in our observations and is as follows: **Alpha type** (commonly called green streptococcus: red corpuscles adjacent to colony "fixed" and pigment changed green, zone of incomplete hemolysis beyond this after 24 to 48 hours' incubation; **Alpha prime type**: zone of incomplete hemol-

Table 2

STREPTOCOCCUS EPIDEMICUS

(From epidemic sore throat)



* **Smooth or S type.** Cells normal in size and shape; biochemical activities marked; uniform clouding in broth; virulent or toxic (if a pathogen); resistant to phagocytosis; associated with acute infections; efficient immunizing agents.

Rough or R type. Cells both large and small and often filamentous; biochemical activities reduced; granular growth in broth; usually lack virulence and ability to produce toxin; more common in convalescence and in chronic infections; susceptible to phagocytosis; usually poor immunizing agents.

quiet environment. All gross dust or dirt particles were removed from the hair around the eyes. All long hairs or lashes around the eyes were cut close to the skin. With sterile Wright pipettes and sterile normal saline, each eye was irrigated twice, using one cubic centimeter of saline each time. The eyelids were gently held apart by the fingers and the saline was introduced at the

ysis; **Beta type** (commonly called streptococcus hemolyticus): clear zone of hemolysis 2 to 4 millimeters in diameter, with destruction of blood pigment around colony; **Gamma type** (commonly called anhemolytic or indifferent streptococci): no change in blood cells.

outer corner. The lids were held apart for approximately one minute during which the excess saline had time to pass out through the puncta lacrimalia. After the lids were released the rabbit would seldom blink. Cultures made from the conjunctival sac from one to sixty minutes after irrigation rarely showed a growth, and when growth occurred, only one or two colonies were present on the entire plate.

The test organisms employed were three strains of Streptococcus exhibiting the alpha type of hemolysis. Strain one was from a case of scarlet fever, strain two from a case of epidemic sore throat, and strain three from the blood in a case of Hodgkin's disease. The rabbit's eye was prepared as stated above, and two drops of a one-millimeter loopful of hemolytic streptococcus suspended in 5 c.c. of normal saline was instilled into the conjunctival sac. The organisms were recovered from the conjunctival sac on blood-agar plates at stated intervals by employing sterile cotton applications moistened with sterile normal saline, drawing these gently over the upper and lower palpebral conjunctivae, and then rotating them evenly over the surface of the agar plates.

In regard to strain one from the case of scarlet fever, observations were made only in regard to effect on the hemolytic properties of the organism. Subsequent to the instillation of the organism into the conjunctival sac, cultures were made after one minute, after five minutes, and every five minutes thereafter up to and including sixty minutes. The results are seen in table 1. After the organism had been in the conjunctival sac five minutes there was a definite influence on the degree of hemolysis. After ten minutes this became more marked as was evidenced by complete loss of hemolytic properties by some of the organisms. After sixty minutes, few organisms remained which had any hemolytic properties and in these cases there had been a modification.

In the case of strain two from an epidemic sore throat, observations were made not only in regard to hemolytic quality but also to cell and colony morphology, and to animal pathogenicity. The method of inoculation and recovery was as before, but the organism was allowed to remain in the conjunctival sac 30 minutes before it was cultured. Also the organism was subjected to conjunctival influence for 30 minutes again after 24 hours' incubation. The results are given in table 2.

Strain three (4 West) from the case of Hodgkin's disease was employed in the same manner as strain two. The results are seen in table 3.

Table 3

STREPTOCOCCUS 4 WEST

(From case of Hodgkin's disease)

S nonhemolytic colorless colonies.
Gram-positive short chains, diplococci, and a few tetrads.

↓

Rabbit Conjunctiva
30 minutes

↓

Blood Agar
S nonhemolytic whitish colonies.
Typical short chains

↓

Rabbit Conjunctiva
30 minutes

↓

Blood Agar

S nonhemolytic green colonies. Gram-positive short-chain cocci and diplococci.	R nonhemolytic green colonies. Gram-positive spindle-shaped bacilli and cocco bacilli, singly and in pairs.
↓	↓
Rabbit Conjunctiva 30 minutes	Rabbit Conjunctiva 30 minutes
↓	↓
Blood Agar S nonhemolytic colorless colonies. Gram-positive cocci singly, in pairs, and short chains.	Blood Agar S nonhemolytic colorless colonies. Gram-positive bacilli, cocci singly, in pairs, and short chains.
↓	↓
Blood Agar S colorless non-hemolytic colonies. Gram-positive cocci in pairs, chains, and clusters.	Blood Agar S colorless nonhemolytic colonies. Gram-positive bacilli with pointed ends and showing evidences of segmentation.

In-vitro production of dissociation is portrayed by a voluminous literature condensed by Hadley in 1927[3], but similar in-vivo experimentation is decidedly in the minority. Animal passage as a means of bringing about this change has been substantiated in regard to B. anthracis[4], B. diphtheriae[5] and Streptococcus[6]. It would seem from the above experiments that there is a definite dissociating factor present in the conjunctival sac. Also these experiments would suggest the presence of a readily accessible exposed surface which might be employed for in-vivo dissociative experimentation. The influence of the conjunctiva upon the employed organisms is evidenced by loss of hemolytic quality, loss of pathogenicity, and varying changes in cell and colony morphology. That this influence is conjunctival is substantiated by the fact that only suitable cultural and environmental conditions were employed except in those few instances where plain agar was used only after the primary effects had been noted, and by the fact that mere transfer of these organisms on the same laboratory media did not result in such changes.

Conclusions

1. The characteristics of hemolytic streptococci introduced into the conjunctival sac are definitely altered.

2. The factor playing the primary part in these alterations is probably the lacrimal secretion, although the conjunctiva itself and other fluids in the conjunctival sac must be considered.

3. These changes include loss of hemolytic quality, loss of pathogenicity, and varying changes in colony and cell morphology.

4. This dissociative attenuation of streptococci by the conjunctiva may be considered as one of the defense mechanisms of the eye against bacterial invasion.

710 S. Lincoln Street.

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NOTES, CASES, INSTRUMENTS

A CASE OF SPONTANEOUS GLAUCOMA IN A RABBIT*

WALTER BECKH, M.D.
BALTIMORE

Spontaneous glaucoma in the rabbit is an extremely rare phenomenon. It therefore seems worth while to report the following instance which occurred in this laboratory.

Case report

The animal in which the glaucoma developed was an adult male albino that formed one of a series used to propagate the virus of yaws. It had been infected intratesticularly with a testicular emulsion containing *T. pertenue,* and had been observed at frequent intervals thereafter. No testicular lesion developed during the period of observation, and it is not certain therefore that a yaws infection had been definitely established in the animal. Five-and-one-half months after inoculation the right eye became enlarged and more prominent. The condition must have developed fairly rapidly, for it had not been observed when the animal was examined two weeks prior to its discovery. I am indebted to Dr. Alan C. Woods for the following description of the affected eye:

"The right eye is definitely enlarged. The right cornea measures 20 mm. in diameter in all directions while the left cornea measures but 15 mm. The cornea is grayish and steamy throughout and the anterior chamber is smaller than usual. The iris is pressed forward toward the cornea and appears somewhat lusterless but shows no significant change. Pupil reacts definitely. The intraocular tension appears elevated to fingers. The tension with the Schiötz tonometer is: Right eye 44 mm. Left eye 14 mm. (The normal values in the rabbit range from 12 to 17 mm. Hg.) With the ophthalmoscope there is a good red reflex everywhere except above, where the shrunken whitish reflex of the medullated nerve fibers is seen. The cornea is too steamy to allow any details of the fundus to be accurately made out. The left eye is quite normal to examination."

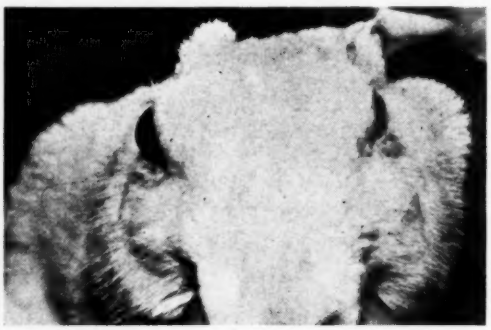
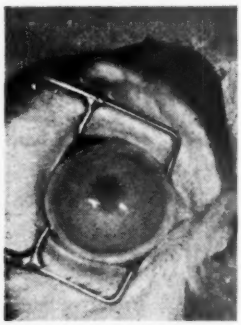


Fig. 1 (Beckh). Front view of albino rabbit with glaucomatous right eye.



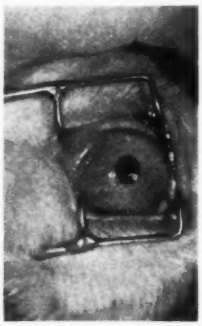


Fig. 2 (Beckh). Right eye glaucomatous, left eye normal.

No change in the condition of the eye was noted during the next 10 days. The eye was then enucleated, and sections were made in Dr. Jonas Friedenwald's laboratory. He has been kind enough to allow me to quote his description of the histological appearance of the lesion:

"The eye ball is much enlarged. There is slight edema of the corneal epithelium; the stroma is normal; there is no cellular infiltration of the limbus. There is some serum in the anterior chamber and there are old peripheral anterior synechiae with complete obliteration of the angle of the anterior

* From the Department of Medicine, Johns Hopkins University, Baltimore, Md.

chamber. The ciliary body is somewhat atrophic. In the region just above the optic disc there is a large area where the retina is completely atrophic and converted into a thick sheet of glial tissue adherent to the scarred and atrophic choroid. There is no active inflammatory reaction in relation to this lesion. Just below the disc there is a small zone in which the rods and cones have disappeared and here also there are no inflammatory lesions. The optic disc and nerve appear to be normal."

Dr. Friedenwald's interpretation was that the chorioretinal scar was quite old, and that it was reasonable to assume the occurrence of a glaucoma on the basis of an old and healed uveitis.

Discussion

The question of the etiology of this glaucoma reduces itself to the question of the etiology of the choroiditis. It is perfectly possible that the animal had a silent yaws infection the only evidence of which was the inflammation in the eye, but from the facts at hand we cannot say that this was definitely the case. Indeed it is not at all certain that a yaws infection had been established in this animal.

No similar case has as yet been reported. Pichler, in 1910, observed primary glaucoma in the right eye of a young and healthy albinotic rabbit, but the condition came to a standstill and no pathological examination was made. In 1919, Vogt reported bilateral buphthalmos of marked degree in a litter of three rabbits with black and white marking, present at the age of 3 months at which time he purchased them. The mating of these animals gave rise to a litter of 3 rabbits all of which showed very marked buphthalmos associated with keratitis bandelette affecting the corneae at the palpebral slit. The affection did not appear until some weeks after birth.

Lakeside Hospital, Cleveland, Ohio.

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METASTATIC OPHTHALMIA IN A CASE OF PNEUMONIA: BACTERIOLOGICAL FINDINGS*

S. Hanford McKee, M.D.
MONTREAL, CANADA

Among the microorganisms producing metastatic ophthalmia the streptococcus ranks first, followed closely by the pneumococcus. Microorganisms such as the meningococcus, the pneumobacillus, the influenza and typhoid bacilli, specific for certain diseases, are also found. A mild course is common in pathologic conditions due to the meningococcus and pneumococcus.

Metastatic ophthalmia occurs chiefly in pyemia, and in rare instances in such acute infectious diseases as typhoid, typhus, variola, scarlet fever, anthrax, influenza, ulcerative endocarditis, diphtheria, erysipelas, Weil's disease, and pneumonia. Axenfeld states, "From material available, we conclude that pneumococcal metastases have a milder course than those due to other important pyogenic organisms. This is shown by the observation that metastases in the course of a pneumonia rarely lead to panophthalmitis and also from the previously recorded findings of Axenfeld and Goh."

A man, G. S., aged 45 years, having lobar pneumonia, was seen in the medical wards of The Montreal General Hospital because of an inflammation which had been present in his right eye for two days. There was some conjunctival congestion, and marked pericorneal injection. The eye was quite painful; the iris was congested and cloudy, and completely bound to the lens capsule. There was pus in the anterior chamber reaching to the pupil.

The patient was the subject of a lobar pneumonia from type-I pneumococcus, which had been cultivated from his sputum and blood on three occasions. The Wassermann test was negative. The patient died within a few days of acute pneumococcic endocarditis, type-I lobar pneumonia of the right

* From the Departments of Ophthalmology and Pathology, The Montreal General Hospital, Montreal, Canada. Read at the meeting of the American Ophthalmological Society, Hot Springs, Va., June 7, 1935.

lower and middle lobes, and pneumococcic meningitis.

At the first examination of the inflamed eye, some mucous secretion was obtained from the inner canthus from which smears were made and blood agar inoculated. Numerous gram-positive lanceolate diplococci were found in smears and a pure culture of pneumococcus type I was obtained. At the postmortem examination an incision was made into the anterior chamber and the pus examined by smear and culture. Gram-positive lanceolate diplococci were found in the smears and a pure culture obtained on media. In each examination from the conjunctiva and from the pus in the anterior chamber the pneumococcus was identified by smear, culture, and the Neufeld method of typing. Mice were inoculated and the peritoneal exudate examined for specific pneumococcal agglutinins and precipitins. Cultures were also made from the heart's blood and peritoneum of the mice and the isolated organism identified by agglutination and cultural reactions. In each instance the pneumococcus isolated was proved by the above methods to be type I.

The interest in this case is chiefly academic, in that, from a case of pneumonia, type-I pneumococcus, the same type of microorganism was cultivated from the conjunctival sac, and from the pus in the anterior chamber.

1528 Crescent Street.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Section on Ophthalmology

March 6, 1935

Dr. J. S. Reynolds, president

The optic nerves

Dr. C. W. Rucker (Minneapolis) listed the causes of retrobulbar neuritis and came to the conclusion that about 70 percent of the acute cases were due to multiple sclerosis.

Discussion. Dr. H. O. Cooperman (Minneapolis) said that the late E. Treacher Collins had stated that there were four causes of sudden blindness; namely, detachment of the retina, embolism into the central artery, postneuritic inflammation, and hemorrhage into the eye. As to differential diagnosis, detachment was visible and embolism was characterized by anemia in the macular region and cherry-red spots in contrast. In regard to retrobulbar neuritis, one could not see any definite pathology of the nerve. For intraocular hemorrhage, Collins did make the axiomatic statement "The doctor can't see into the eye and the patient can't see out of it."

Dr. C. W. Spratt (Minneapolis) stated that many could remember the papers by Dr. Leon White of Boston, and others, in which marvelous cures for retrobulbar neuritis followed the operation on the ethmoid sinus even when no infection was present. Later, Cushing called attention to a number of cases of brain tumor with eye symptoms in which an ethmoidectomy had been done. Dr. Spratt said that about this time he had become interested in the subject of retrobulbar neuritis and had collected about a dozen cases in which spontaneous recovery had followed and, to his mind at least, there was considerable doubt as to the relationship of ethmoid infection and retrobulbar neuritis. Later, Dr. White had published one or two papers in which his enthusiasm for the ethmoid operation had diminished and had stated that his earlier belief in the intimate relationship between retrobulbar neuritis and sinus trouble was in error.

Dr. Anderson Hilding (Duluth) said that if one saw such patients ten years later, they would show some advanced symptoms of multiple sclerosis. He said he recently had had two of these cases with central scotomas; in neither of them could he find cause. One patient recovered.

Dr. V. J. Schwartz (Minneapolis) said that examination of a very early optic neuritis might occasionally show no evidence of pathology when viewed with the ordinary light. If, however, the examination were made with red-free light, definite changes might be seen. The difference was occasionally astonishing.

Dr. H. V. Hanson (Ft. Snelling) stated that experiments made on dogs in which a ligature placed around the optic nerve anterior to the point of entrance of the veins into the nerve when tightened to a point just short of shutting off the arterial flow resulted in large distended veins but papilledema did not develop.

Dr. Paul Berrisford (St. Paul) expressed the view that, in the light of Dr. Rucker's statistics, given a case of reduced visual acuity, negative ophthalmoscopic findings, with central scotoma for red and green, and a negative history for alcohol and tobacco intoxication, the case should be considered one of multiple sclerosis until proved otherwise.

Dr. C. W. Rucker stated that Adie had said that in his cases the average length of time between loss of vision and other symptoms of multiple sclerosis was eight years, and in one case twenty-four years. Before one could say with assurance that a case of retrobulbar neuritis was not due to multiple sclerosis, one must wait at least several years.

Dr. Berrisford said that remissions in multiple sclerosis were quite characteristic and that one should keep this in mind in order to avoid a too optimistic prognosis.

Skin lesions related to eye, ear, nose and throat

Dr. H. E. Michelson (Minneapolis) (by invitation) gave a lantern-slide talk on this subject.

Walter E. Camp,
Secretary.

BALTIMORE CITY MEDICAL SOCIETY

Section on Ophthalmology

March 28, 1935

Dr. Lloyd B. Whitham, chairman

Some phases of plastic surgery around the eye

Dr. John Staige Davis described the condition of inability to close the upper eyelids on account of upward traction due to deep scarring of the whole head down to the brows from scalping. To correct this, he implanted a wide band of thick skin all the way across the forehead, releasing tension and enabling the lids to close. In the deformities left after radical frontal-sinus operations in which the arch of the eyebrow had been removed, he implanted rib cartilage. To replace the eyebrow, he selected a strip of hairy skin from the scalp with the hair running in the proper direction. This brought over to the region of the eyebrow with its blood supply, the anterior temporal artery, which was carefully dissected out for a length of about six inches and slid under a skin flap to the desired area.

Radium in corneal lesions

Dr. Laura Lane stated that radium gave results in extensive leucomas and corneal opacities. In painful lesions of the cornea, radium, having an analgesic effect, was an acceptable therapeutic measure. The application of radium to the eye was painless.

Fistulae and ulcers of the cornea, including various forms of keratitis rosacea, and tuberculosis responded well to radium therapy; the latter with or without tuberculin. Radium promoted absorption of exudate and was useful in hypopyon ulcers. Keratitis dendritica, which is very stubborn with any form of treatment, responded early to radium therapy. The pannus of trachoma and other vascular conditions of the cornea responded to small applications of radium.

In malignant lesions radium offered results equal to surgery, and in many cases with much less loss of tissue and scarring. The doses were large. In some cases the growth disappeared so completely with radiotherapy that one could not detect the scar with a slit-lamp.

The application of radium to the cornea calls for a knowledge of the physics of radium, of the structure of the cornea and of the eye, and the exercise of considerable judgment as to dosage. It should be undertaken only by those who are willing to give individual attention to its use.

The curved cataract knife and its advantages

Dr. R. Townley Paton described the following advantages obtained from the use of a cataract knife curved on the flat, the convexity of which was on the upper surface when the knife was held in the operative position: (1) safety to the iris in cases with shallow anterior chamber; (2) coaptation of curve to shape of eyeball; (3) larger and more compact healing surface due to beveled incision; (4) far less binding of the knife at the edges of the section, especially in cases in which the lens bulged forward.

The ordinary cataract knife is easily curved. The steel must be retempered after the curve has been made. Curved knives may be resharpened, like the ordinary straight-bladed knife. There must be a uniform radius of curvature from the point to the heel. Ordinarily the best curvature should not exceed 1 mm. above the horizontal.

It was never found difficult to make

counterpuncture with this knife as long as the curvature did not exceed 2 mm.

Moving-picture fusion-training apparatus

Dr. R. Townley Paton displayed a working model of a fusion-training apparatus. The new feature in this apparatus was that the images were moving pictures. Two separate small motion-picture machines were enclosed in a box side by side. Similar pictures from these were projected on a translucent screen in the front of the box.

An ordinary stereoscope was placed in front of the translucent screen through which the patient observed the moving pictures. The films on each machine were identical except for a missing part which was scratched off one of the films.

The images on the screen could be separated laterally by a control on the outside of the box; they could be separated up and down by suitable prisms inserted in the stereoscope or in front of the screen in the box in order to increase lateral and vertical amplitude.

Each image could be increased or decreased in illumination while the other remained stationary. The flicker, incident to the motion picture, was considered an asset in holding the child's attention. The moving pictures themselves held the child's attention very much better than ordinary still slides.

Mary L. Small,
Secretary.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

April 16, 1935

Dr. James J. Regan, presiding

Stationary traumatic cataract

Dr. Ralph Ruggles presented a patient who had had an intraocular foreign body that had passed through the lens into the anterior part of the vitreous. With a large magnet the small piece of steel had been pulled around the lens into the anterior chamber, and had been removed through a keratome incision without iridectomy. At the time of the meeting the patient's eye appeared to be perfectly normal except for a small corneal linear opacity at the site of entrance of the foreign body, and a small notch in the iris sphincter through which the foreign body had passed. The absence of pigment in this latter area first called Dr. Ruggles's attention to the presence of the foreign body. Two months after removal of the foreign body, the patient's vision was still 20/20, and there was no evident change in the opacity of the lens.

Discussion. Dr. Virgil G. Casten reported a case, similar to that of Dr. Ruggles, of a 19-year-old garage mechanic whose eye had been struck by a piece of steel on September 1, 1933. The foreign body had perforated the cornea and the lens, and had lodged in the choroid about 8 disc diameters up and out from the nerve head. The path of the foreign body through the lens could be easily seen. The iris had only a small laceration. On attempting to remove the foreign body with a giant magnet it was noted that each time the current was turned on the foreign body came forward but as soon as the current was cut off the foreign body jumped back to its original position. It was seen that this procedure was causing a separation of the retina. Following the advice of Dr. Walter Lancaster, who was called into consultation, the foreign body was removed by the posterior route, and the choroid was coagulated by diathermy. Twenty months after operation, the patient still had 20/15 vision in each eye with correction of moderate errors of refraction. The tension and visual fields were normal. There was a small scar of the cornea and anterior lens capsule, a streak through the lens, and a larger posterior capsular opacity.

Convalescent blood for herpes zoster

Dr. Trygve Gundersen read a paper on the above subject which was discussed by Dr. E. Lawrence Oliver. This paper was a thesis presented to the American Board of Ophthalmology by Dr. Gundersen as a candidate for membership in the American Ophthalmological Society.

Trygve Gundersen,
Recorder.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

April 15, 1935

Dr. W. W. Wilkerson, Jr., chairman

Retained intraocular foreign body

Dr. Kate Savage Zerfoss presented Mr. F. C., aged 30 years, who had a copper-colored piece of metal embedded in the lower temporal quadrant of the iris of the left eye. The anterior extremity projected into the anterior chamber. No exact dates could be assigned as to the time when such a foreign body might have entered the eye. His vocation was instructor in an automobile school.

There were two scars in the nasal quadrant of the cornea. A slightly opaque area connected them. No other corneal lesions were noted. The conjunctiva was moderately injected.

The patient refused any operative procedure although the possible complications were suggested to him. Dr. Robert Sullivan saw him in consultation.

When seen at the end of two-and-a-half years for the removal of a foreign body in the conjunctival sac the eye was found to be unchanged. The metal was less glistening and of a duller copper color.

This case was reported because of the following features: (1) no history of the time of penetration of the foreign body; (2) the lack of irritation from a foreign body in the iris; (3) the importance of a complete examination of an eye at all times; (4) the advisability of calling a consultation in order to share responsibility, especially if conservative measures are adopted.

Cyst of the retina

Dr. J. L. Bryan presented a young lady, aged 17 years, who wanted an opinion on the condition of the right eye. There was no external manifestation of pathology. The cornea, media, and lens were clear. The right eye was blind and the left eye had vision of 20/20. She had had a fall about three years before, hurting the back of her head. Three months later she noticed that the vision of the right eye was gone. She complained of pain in that eye at the time of injury. She received treatment at Vanderbilt Hospital where glasses were prescribed which improved the vision. Later she returned to work; this eye began to give trouble again.

Ophthalmoscopic examination gave the picture of an optic neuritis; also an extensive detachment of the retina which was low and quite far forward. The probable presence of a tumor was suspected. Ocular movements were normal; the rest of the examinations were negative, except for dark maxillary sinuses. The tonsils had been removed eight years before. The teeth and gums were in fair condition and the Wassermann test was negative. She was placed on ascending doses of potassium iodide. Frequent examinations of the eye showed that the condition was gradually growing worse. The eye was enucleated and a retinal cyst found.

Kate Savage Zerfoss,
Secretary.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

May 20, 1935

Dr. W. W. Wilkerson, Jr., chairman

Trephining for glaucoma

Dr. H. C. Smith said that in reporting these cases of glaucoma which he had treated by trephining, it was not his aim to make any claim for the efficacy of that procedure over any other one. It was simply his desire to mention the interesting facts in his experience, and to evoke discussion of the surgical care of glaucomatous patients. He did not believe that central visual acuity was the criterion by which results should be judged, but rather that maintenance of the visual field and prevention of the pain which occurred late in chronic glaucoma were important.

He said that an attempt was made in every operation completely to remove the scleral flap, and to obtain only par-

tial iridectomy. Instillation of two-percent solution of butyn and four-percent solution of cocaine, with subconjunctival injection of two-percent novocaine, was employed for anesthesia.

Corneoscleral trephining by Elliot's method was performed upon 23 eyes. These had been observed from nine months to four-and-one-half years. The patients, 20 in number, ranged from 29 to 78 years of age; there were 16 white, and 4 colored. The majority had presented themselves with advanced loss of vision from chronic simple glaucoma; one had acute congestive, and one had secondary glaucoma. In three, there was bilateral chronic, and in one, bilateral acute glaucoma. Only seven possessed one normal eye. Seven had absolute glaucoma, for which six enucleations had been done. One had traumatic rupture of the globe, for which the eye had been removed. Vision equal to that which the patient possessed before operation had been maintained in 19 eyes. In these eyes the field of vision had remained the same, except for slight enlargement in one case. Loss of the field had progressed in four eyes, this in spite of good filtration with constant lowered tension in one case. Adequate filtration, as evidenced by a good filtering bleb, had been secured in 20 eyes, and in these the intraocular pressure had remained low. The filtering bleb failed to develop in three eyes.

As a complication at the time of operation, perforation of the conjunctival flap occurred three times. This seemed not to affect the result in two cases; however, in the third, the filtering bleb never formed. In no case, was there extreme bleeding from the iris, and persistent hyphemia did not occur. Choroidal detachment was seen in one eye. Cataract developed in one eye ten months after trephining was done. The hospitalization period averaged eight days.

Pyogenic granuloma

Dr. W. G. Kennon presented B. A., aged 53 years, who was first seen July 1, 1934, at which time he had facial erysipelas with abscesses of the upper and lower lids of the left eye. He finally recovered and was discharged from the hospital about August 9.

On August 22, 1935, the patient returned on account of a growth 5 mm. by 8 mm., on the conjunctiva of the lower lid of the right eye. Surgical intervention was refused for fear of a recurrence of the erysipelas. On May 13, 1935, he returned with the mass about doubled in size.

Kate Savage Zerfoss,
Secretary.

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* Deceased.

PARTIALLY SIGHTED EYES

Our definitions of blindness for social and industrial purposes need to be supplemented by recognition, classification, and special care of eyes that have only partial sight. Before the work of the ophthalmologist in preventing blindness can be fully effective, it must be recognized that in the majority of cases the changes that end in blindness begin and go forward for years before they entirely destroy the sight. The partially sighted persons are those for whom efforts to prevent blindness are most effective. But eyes with poor sight are often neglected, especially if one eye still can see enough for practical purposes.

The late Holmes Spicer, at St. Bartholomew's Hospital in London, treated an eye for cataract by the ancient operation of couching. This eye had a partially dislocated lens; the other eye had been entirely lost by inflammatory changes and detachment of the retina. The man got only one-tenth vision by the operation; but it enabled him to earn his living by the same work that he had done before he lost his other eye. This case illustrates the great value of greatly impaired vision to the patient for whom better vision is not possible.

Too often an eye with defective vision is left to its fate, especially if the other eye has better vision for practical use. The greatest value of two eyes is the service one can render when the other is lost. To throw away this chance by neglect is bad practice, even when the bad eye seems quite useless, as compared with one having full vision. We cannot foresee when an eye having poor sight, may become invaluable. We have no right to deprive a patient of his chance for some sight.

This does not mean that an eye with light perception should not be removed when it threatens sympathetic ophthal-

mia for a healthy eye. It does not mean that every patient with bilateral cataract should have both eyes operated upon. But it does mean that every eye which is seriously damaged should be treated, so as to save as much vision in it as possible; and its treatment, or care, must be continued so long as this is necessary to give the best vision possible to it; no matter how superior may be the vision in the other eye. Congenital subluxation of the lens may cause great defects of vision; but it should not on that account be allowed to cause blindness by cataract, glaucoma, choroidal atrophy, or detachment of the retina.

The diseases and accidents of childhood often leave impaired sight, and perfect cure may be impossible. Some of these eyes become blind in old age. Eyes damaged by measles or scarlet fever may become blind after fifty. But care not to tax these eyes beyond their powers would have saved many from blindness. Trachoma in some countries is a most important cause of blindness; but in these cases years of neglect intervene before blindness results. Myopia commonly begins in school life. It is a trifling inconvenience to start with; but, unchecked by the wearing of correcting glasses and care of the eyes, it may go on to cataract, atrophy of the choroid, and detached retina. The scar from a corneal ulcer may be scarcely visible in a child, yet the impairment of vision in one eye may lead to holding things close to the eyes, and myopia in both eyes may result with its disabilities and danger in later life.

For many children school work is the hardest work they will ever have to do. To remove or care for the slight defects they may have, and to teach them to use their eyes to the best advantage, will be the most important work for the prevention of blindness. They and their parents are generally ignorant of the danger of neglecting slight defects that, under the strain of modern life, may later disable them. No more important instruction can be given them than the teaching of what is good vision, and what they can do to preserve it.

Edward Jackson.

ARRANGEMENT OF STEREOSCOPIC ILLUSTRATIONS

In these days of improved fundus and anterior-segment cameras, many ophthalmologists are using photographs for permanent records and for illustrating articles on ophthalmic problems. A natural accompaniment of this is the stereoscopic reproduction. To be able to view the object in its three dimensions is obviously in many cases a great advantage, as the picture is more lifelike and at times does definitely show features that are lost when depth perception is omitted.

Nevertheless, because of the additional expense of their reproduction as well as the extra space which they occupy and other considerations to be discussed later, editors must evaluate them in the same manner as they do colored pictures; namely, they must decide whether the pictures add anything that cannot be shown in single black-and-white photographs. If the advantage is merely one of more beauty or interest, this feature must, in case of a scientific publication, be very obvious, else the simpler method should be used.

The average small black-and-white halftone costs between five and ten dollars to reproduce, whereas a stereoscopic picture will cost fifty percent more, and a colored illustration perhaps fifty times as much.

Another factor in publishing stereos is the difficulty of rendering them usable. This is a simple matter when the intention is to construct a card which can be readily inserted into a stereoscope but something very different when the reproduction is to be printed in a journal. The editor has tried to find out what percentage of the readers of the American Journal of Ophthalmology actually view stereoscopically the pictures arranged for that purpose in the Journal. As far as he could determine, very few indeed take the trouble to do this. To place the magazine in a stereoscope is impossible and to hold the book in front of the rack intended for cards is equally impossible on account of the crossbar of the stereoscope, which will not permit the lower-

ing of the magazine sufficiently for it to be viewed through the prism system unless the photographs are near the bottom of the page. To be sure, lenses and prisms can be set in a trial frame in imitation of those in the stereoscope but this is a nuisance and few readers will bother to do it.

In an attempt to surmount this obstacle the editor conceived the idea that since many have the ability to view stereos stereoscopically without prisms and plus spheres, he would aid these readers by placing the two pictures closer together than for a stereoscope. He is not sure that the idea is proving a success. Though the procedure for seeing depth in these pictures has often been described, it is perhaps not yet well understood and also is easier for the presbyopic than for the younger person. The journal should be held at from eight to twelve inches from the eyes and accommodation relaxed. Care must be exercised that the two photographs are exactly level, or an element of hyperphoria will be introduced rendering the undertaking more difficult. At once, not two but three pictures will be seen. The middle one is the one that will appear stereoscopically. The book should be moved forwards and backwards until the most comfortable vision is obtained. If the reader will turn to page 606 of the July number he will find two stereos placed slightly less than two inches apart. These can be readily fused without a stereoscope by most persons, after a little experimentation. Those set farther apart, intended for use in an instrument (see this Journal for April, 1933, opposite page 289, the separation here being two-and-one-half inches), can be fused without a stereoscope but with much more effort.

Which method is preferable in this Journal is not clear to the editor. He has had understandable and reasonable complaints about both. One other idea has occurred to him and that is to separate the illustrations as for the stereoscope and place them flush with the bottom of a page. This would necessitate employment of an instrument for most readers but would at least permit of its use without destruction of the magazine. Expression of opinion or suggestions on this subject would be welcomed by the editor.

Lawrence T. Post.

BOOK NOTICES

L'extraction capsulo-lenticulaire de la cataracte (Capsulo-lenticular extraction of cataract). By R. de Saint-Martin. 425 pages, 76 figures, and 15 colored plates. Paper binding. Paris, Masson et Cie, 1935, price not stated.

The author has suggested a new expression, capsulo-lenticular, for intracapsular extraction of cataract and utilizes it as the title of this very excellent monograph on the subject. It is by far the most complete that has come to the reviewer's attention. The presentation is simple and logical. The opinions of most of the best known ophthalmologic surgeons are quoted. Throughout the text are comments by the author on his own experience, which has been of no small amount, as witness the included report of 643 of his own intracapsular extractions.

The table of contents gives a good idea of the scope of this work. The first part includes the discussion of the definition, the historical statement, and the anatomy, 40 pages in all. The second part on the technique of the operation includes nine chapters with a total of 264 pages. All of the various types of intracapsular operation are discussed in detail: the preparation for operation, the actual technique, the accidents and complications both operative and postoperative. Not only does he give detailed information how to avoid complications but what to do when complications occur. The third part contains three chapters, totaling 65 pages; the first on the published results, the second on contraindications, and the third on the discussion of the advantages of this method. A fourth chapter of 18 pages discusses the respective merits of intra- and extracapsular extractions.

The illustrations are excellent; the colored plates beautifully executed and

wisely selected. Print and paper are good. The only disappointing feature is that the binding is of paper instead of cloth. This is true of all of the books in this splendid collection. Each of them has been most meritorious and would make a beautiful permanent addition to a private collection if the cover would stand the wear of usage. Any ophthalmologist who is now performing or intends to perform intracapsular extraction and who has a reading knowledge of clear and concise French should be in possession of this book.

Lawrence T. Post.

OBITUARIES

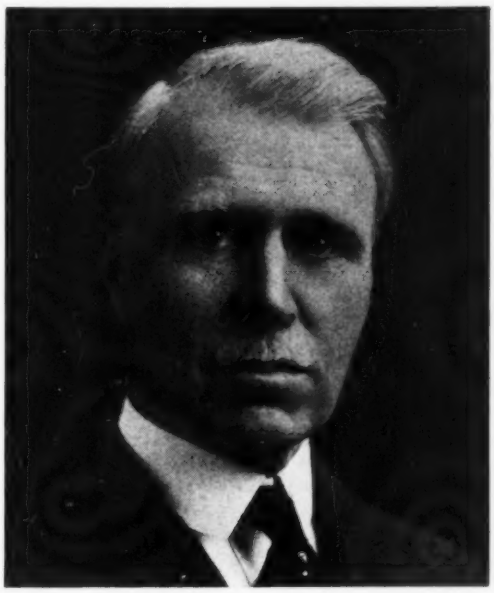
William Hamlin Wilder, M.D., 1860-1935

Dr. William Hamlin Wilder was born at Covington, Kentucky, on December 16, 1860, a son of Josiah and Emma (Morse) Wilder, both of prominent old families and a direct descendant of Edward Wilder who settled in the Hingham Colony, Massachusetts, in 1638. He attended the public schools of College Hill, Ohio, and Belmont College, graduating from the latter institution in 1878, at the age of 18 with a degree of Bachelor of Arts. He taught school for two years, covering the 20-mile ride to and from his home on horseback. During this time he devoted all of his spare time to the reading of medical subjects.

He matriculated at the Medical College of Ohio (University of Cincinnati) in 1880, and was graduated with the degree of Doctor of Medicine in 1884, having served as Resident Physician in the Cincinnati Hospital for more than a year previous to his graduation. Practicing general medicine in Cincinnati until 1889, he decided to prepare himself for the exclusive practice of ophthalmology. For nearly three years he studied under some of the most noted preceptors of Europe, Fuchs, Nettleship, Tweedy, Leber, Orth, Virchow, and Koch.

In the fall of 1891, Dr. Wilder moved to Chicago, and for nearly twenty years was Professor of Ophthalmology at Rush Medical College (University of Chicago) and was appointed Professor Emeritus in 1926.

He worked under Dr. Edward L. Holmes at the Chicago Polyclinic and because of his special interest and ability in pathology was appointed pathologist at the Illinois Eye and Ear In-



William Hamlin Wilder, M.D.

firmary where he established out of his own limited income and with his own equipment a laboratory which was the first of its kind in Chicago.

Dr. Holmes soon appointed him to his staff at Rush Medical College, and in 1907 Dr. Wilder succeeded Dr. Hotz as Head of the Department of Ophthalmology of Rush Medical College and Chief Surgeon in Ophthalmology at Presbyterian Hospital. He was also appointed Surgeon in Chief at the Illinois Eye and Ear Infirmary.

He helped to found the Illinois Society for the Prevention of Blindness and was its active vice-president since its inception.

The Dana Medal for outstanding work in the prevention of blindness and the conservation of vision was awarded to Dr. Wilder last May in St. Louis. The medal bears the inscription:

"Wise Clinician, Devoted Teacher and Humanitarian."

One of the principal interests that dominated Dr. Wilder's life was the desire to elevate the standards of medicine, particularly ophthalmology; and the American Board of Ophthalmology was the instrument to effect this ambition. He was one of its organizers and had been the active secretary since 1918. Physicians in several other specialties, having recognized the value of the Board of Ophthalmology, have, with his assistance, established such Boards.

Dr. Wilder has also gained distinction as a writer and was the author of articles in a "System of Ophthalmic Surgery." He was a frequent and valuable contributor of many articles to medical journals and magazines and collaborated in the editing and publishing of various books on ophthalmology.

He was president at various times of the American Ophthalmological Society; chairman of the Section on Ophthalmology, American Medical Association; president of the American Academy of Ophthalmology and Oto-Laryngology; and president of the Chicago Ophthalmological Society.

All of Dr. Wilder's work, whether medical, business, or social, was characterized by perfect deliberation and care of the minutest detail. The influence of Mr. Nettleship was evidenced all through his life. In his letter of recommendation, Nettleship writes on May 3, 1891: "He is a most painstaking and conscientious worker; and he is entitled in all respects to look forward to success in his profession." His thorough and painstaking methods of examination, his keen sense of observation and judgment, and his conservative attitude in operative work won for Dr. Wilder, within a comparatively short time, the admiration of his confrères who came to him for consultation and advice.

He died on September 24, 1935, of cerebral arteriosclerosis and paralysis agitans. He is survived by his widow, a daughter, and a son, also a physician. Two grandsons are now studying medicine.

Thomas D. Allen.

Adolph Barkan, M.D., 1844-1935

Dr. Adolph Barkan, professor emeritus in ophthalmology at Stanford Medical School, died August 28, 1935, at the age of nearly ninety-one years. He came to this country as a young man of twenty-three and after spending one year in Baltimore went to San Francisco.

From the very beginning of his career he was the leader in ophthalmology in the Far West until the day of his retirement from practice and his duties at the Cooper Medical College, later Stanford Medical School, in the year 1912. He founded a school of pupils who were successful in their work from one end of the Pacific coast to the other. For forty-five years, he gave of his time most liberally, in order to teach in and conduct the largest eye clinic in the Far West. He was a natural born teacher and a very skilled operator. In later life he collected a large library of ophthalmic literature and of the history of medicine, presenting it to the Lane Medical Library with sufficient finances to keep it enlarging and to maintain the acquisition of current journals.

Outside of medicine his chief interest lay in music and in the cultural development of the community along musical lines. The last twenty-five years of his life were spent in Europe where he collected etchings and more books for the library on the history of medicine.

Six feet in height, with a gray beard, very active up to the age of his retirement, he was a figure familiar to every San Franciscan. His was a long record of useful ophthalmic and cultural activities in his adopted home.

Lawrence T. Post.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy and embryology

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1. GENERAL METHODS OF DIAGNOSIS

Bane, W. C. **Amateur photography of the exterior of the eye.** Trans. Western Ophth. Soc., 1st annual meeting, 1934, p. 96.

The author describes the simple technique for making black and white pictures of the eye by the use of an accessory lens over the ordinary photographic lens, and with an ordinary folding camera. Lumière color plates can be made in the same way but require sixty times the exposure. Agfa color plates require thirty times the exposure necessary for black and white pictures.

George N. Hosford.

Disler, H. H. **A slitlamp.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 536.

A hand slitlamp is described.

Ray K. Daily.

Kaminskaia, Z. **Biomicroscopy of the anterior segment of the eyeball in tuberculosis.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, 529.

Suggestive of tuberculous etiology are sharply circumscribed corneal infiltrations, scattered through the entire cornea and most marked toward the limbus; superficial and deep newly-formed anastomosing blood-vessels; coarse folds in Descemet's membrane, frequently remaining after subsidence of the inflammation; retarded circulation in the anterior chamber; irregular fatty precipitates on the posterior corneal surface; fugitive nodules at the pupillary border; and destruction of the pigment epithelium of the iris.

Ray K. Daily.

Kyrieleis, Werner. **Does a physiologic weakness of attention exist at the nasal periphery of the visual field?** Arch. f. Augenh., 1935, v. 109, July, p. 190.

When a test object approaches from the temporal side, its oncoming is heralded by vague and uncertain stimuli long before it is recognized. Anatomic hindrance prevents such announcement of objects entering the monocular visual field from the nasal side. In the binocular visual field the object has to traverse forty degrees of the monocular field before it enters the nasal field of the other eye and is seen binocularly, and it is thus reported far in advance of its recognition. The binocular field so taken has its boundary line five degrees farther peripherally than the corresponding monocular field.

R. Grunfeld.

Kyrieleis, W. and A., and Siegert, P. **Visual field examinations in an oxygen-deficient atmosphere and under low barometric pressure.** Arch. f. Augenh., 1935, v. 109, July, p. 178.

The authors used an oxygen-deficient air and a barometric pressure corre-

sponding to an altitude of eight thousand meters. In none of their experiments could they detect contraction of the visual field either for form or color. The authors explain the contrary findings of other investigators as due to the altered state of mind of the examined persons at high altitude, and to the fact that these persons were examined with a black object on white, instead of with a white object on gray background. At high altitudes symptoms due to reduced barometric pressure (mountain sickness) come into play, such as diminished attention, increased reaction time, and apathy.

R. Grunfeld.

Lijo Pavia, J. **Biophotomicrography.** Rev. Oto-Neuro-Oft., 1935, v. 10, July, p. 176. (See Amer. Jour. Ophth., 1935, v. 18, Sept., p. 877.)

Lijo Pavia, J. **Sixth observation of green fundus patch.** Arch. de Oft. de Buenos Aires, 1935, v. 10, June, p. 438. (See Amer. Jour. Ophth., 1935, v. 18, Oct., p. 973.)

Lopez Enriquez, M. **New addition to microscopy of the living cornea.** Klin. M. f. Augenh., 1935, v. 95, July, p. 77. (Ill.)

By means of a double mirror the apparatus which is described and illustrated avoids conflict between the observation and illumination systems.

C. Zimmermann.

Mann, W. A., Jr. **Infrared photography of the eye.** Arch. of Ophth., 1935, v. 13, June, pp. 985-991.

The power of the long infrared rays to penetrate cloudy media which reflect and disperse the shorter visible rays is utilized in photographing the anterior portion of the globe with specially sensitized plates (Eastman infrared plates, type 1-R), using a filter (Wratten no. 25) which occludes the visible rays but permits the infrared rays to pass. A number of photographs clearly demonstrate how the iris and pupil can be visualized in spite of corneal opacities.

J. Hewitt Judd.

2. THERAPEUTICS AND OPERATIONS

Barbel, I. E. **The lysozyme content of tears after operations on the eyeball.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 446.

Studies were made on twenty postoperative cases. In most of them there was a fall in the lysozyme content immediately or within the first twenty-four hours after operation, followed by a rise. The lowest lysozyme content was seen after glaucoma operations. The lysozyme content seemed to bear no relation to the postoperative course.

Ray K. Daily.

Chautin, S. M., and Zlatkina, E. I. **Lysate therapy in ocular diseases.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 5, p. 713.

Various ocular diseases were treated with eye lysates. The author concludes that these act well in scleritis, keratoconjunctivitis, and iritis, and that they are indicated in sympathetic ophthalmia. Severe inflammations indicate administration of small doses. The injections are painless and cause no reaction.

Ray K. Daily.

Cooper, Edmond. **A note on preoperative eye cultures.** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 850-851.

Hartleib, Robert. **Harmfulness of pantocaine?** Klin. M. f. Augenh., 1935, v. 94, June, p. 800.

Hartleib attributes the deleterious effect of pantocaine reported by Adam (Amer. Jour. Ophth., 1935, v. 18, p. 786) to the employment of a two percent solution, which is far too strong. The author has seldom seen irritation by 0.5 percent for anesthesia or from 0.2 to 0.3 percent for treatment.

C. Zimmermann.

Klauber, E. **Lesion of the cornea by pantocaine.** Klin. M. f. Augenh., 1935, v. 95, July, p. 87. (See Section 16, Injuries.)

McCool, J. L., and Dickey, C. A. **Single suture rethreadable needle.** Amer. Jour. Ophth., 1935, v. 18, Sept., p. 855.

Moose, R. M. **Revelations of detailed diet histories obtained in the practice of ophthalmology and otolaryngology.** Arch. of Otolaryng., 1935, v. 21, Jan., p. 64.

The author suggests that a detailed diet history be taken of all cases to determine lowered resistance to infection. In the series studied, nearly half of the patients were markedly deficient in animal protein and calcium, and 73 percent needed guidance in the choice of their food. M. E. Marcove.

Saburov, G. I. **Ultrashort waves.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 541.

This is a description of a short-wave apparatus and its action.
Ray K. Daily.

Sachs, M. **Preparation for ocular operations.** Wien. med. Woch., 1935, Nos. 29-30, July 13, p. 794.

In cataract patients, arterial blood pressure is of prime importance. Where there is hypertension, phlebotomy of from ⅓ to 7/10 liter is done.
Theodore M. Shapira.

Tarusov, B. H., and Mairanovski, G. M., and Fradkin, M. I. **Heating ocular tissues with short waves.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 549.

This is a graphic report of the action of waves of different length on the various ocular tissues. Ray K. Daily.

Urniszevskaia, B. C. **The use of spool thread in ophthalmology.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 568.

The author found that soaking cotton thread in ten percent formalin solution for several weeks made it almost as strong as silk. Ray K. Daily.

Utkina, K. A., and Teitel, L. B. **The bactericidal action of short and ultrashort waves.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 546.

The author reports the bactericidal action of extremely shortwaved rays on cultures of staphylococcus hemolyticus and pneumococcus at various temperatures. Ray K. Daily.

3. PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Brandstedt, Gosta. **Studies on the minimum perceptible and the discriminative ability of the eye.** Acta Ophth., 1935, supplement 5.

The objective of this very exhaustive treatise is to determine the reaction of the light sense to myopia. Methods used in previous investigations were primitive and inaccurate and the material studied relatively small. The author examined 1,534 myopic and 1,015 nonmyopic eyes. The minimum perceptible was determined with Gullstrand's photoptometer, the light-difference sense with the Möller-Edmund scotoptometer. Tables, charts, and diagrams of the results show that sex has no influence on the light sense. For normal eyes, after one-half hour of dark adaptation, 2/100,000 candle power was the most frequently found minimum perceptible. The latter rises with age and with diminution in visual acuity. In myopia the threshold of perception is higher than in normal eyes, and it rises with diminution in visual acuity, with increase in myopia, and with development of fundus changes. The light-difference sense also deteriorates with age and with loss in visual acuity. It is poorer in myopes and is influenced by the same factors as the minimum perceptible. The light-difference sense is poorer in myopic anisometropia, and more so in the more myopic eye; the difference in the two eyes being independent of intensity of illumination. In hyperopic anisometropia the more hyperopic eye has lower visual acuity and poorer light-difference sense; the difference diminishing with reduced illumination, so that in a very poor light both eyes function equally well. Reduced illumination reduces visual acuity and light-difference sense to a greater extent in myopes than in hyperopes. Ray K. Daily.

Dimshitz, L. A., and Mikaeljan, P. X. **Dark adaptation in aphakia.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 440. (See Section 9, Crystalline lens.)

Guibor, G. P. **Strabismus in children corrected by refraction alone.** Amer. Jour. of Ophth., 1935, v. 18, Oct., pp. 944-949.

Jackson, E. **Optical aberrations of the eye.** Trans. Western Ophth. Soc., 1st annual meeting, 1934, p. 110.

The author calls attention to the fact that in refraction work aberrations have been ignored, but that their effects have been largely responsible for mistakes and controversies that have beset the correction of errors of refraction. The aberrations may be due to the cornea or the lens and may depend on irregularities of either surface or of the index of refraction. Changes in the crystalline lens that often produce changes in regular astigmatism, hyperopia, or myopia are common after fifty years of age, and sometimes earlier, and are often attended by changes of aberration. Such changes cause the polyopsia often complained of in early senile cataract. In general the effects of aberration are diminished by contraction of the pupil, and in some cases the regular use of a miotic is justified. George N. Hosford.

Kogan-Bernstein, B. A. **Color perception in transportation industry.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 5, p. 684.

Because elimination of many experienced workers with defective color vision was hard on the transport service, departmental heads questioned the practical accuracy of tests. To convince them a practical test was arranged on a railroad line with flags and semaphores. The graphic report shows the danger of employing people with defective color vision. Any degree of color blindness should bar an applicant from employment in the transport service. The findings with Holmgren's skeins and with Nagel's tables are inaccurate; and examinations should be made with Stilling's and Ishihara's plates and Nagel's anomaloscope.

Ray K. Daily.

Lancaster, W. B. **Stigmatoscopy.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 130-142.

The author urges that students shall be taught the action of lenses, mirrors, and prisms from actual experience in the optical laboratory. Study of optical imagery is based upon examination of a point of light, after placing various lenses in front of the dilated pupils. Thus defects in focus such as astigmatism, aberration, and asymmetry may be subjectively studied. A syllabus on optics, visual physiology, and general physiology and biochemistry of the eye is also presented. C. Allen Dickey.

Lehrfeld, Louis. **Visual allergy to light and intolerance to light.** Arch. of Ophth., 1935, v. 13, June, pp. 992-1013.

Ocular allergy to light exists principally as a physical allergy related to solar and dermatographic urticaria, but it is possible that in certain pathologic states the visual pathways are rendered sensitive to light or its spectral parts and that a true chemical allergy may thus occur. Tolerance to light depends not only on the deposition of pigment in the eye and on the sensitiveness of the light-receiving and light-conducting apparatus, but also on the light at its source and its mirrored reflection on the cornea and lens. Experiments conducted on students showed that under conditions of intolerance to light all experienced a greater degree of comfortable vision and over a longer period of time with tinted lenses than with white. The transmissive properties of tinted lenses and the psychology of color are considered. It is concluded that tinted lenses of a color pleasing to the eyes and having uniform transmission of all visible wave-lengths will reduce intolerance, maintain a maximum visual acuity, and subdue actual physical light-allergy. (Tables.)

J. Hewitt Judd.

Marchesini, Ettore. **Relation between interpupillary distance and ocular refraction in ametropic eyes.** Ann. di Ottal., 1935, v. 63, June, p. 461.

Having examined 502 ametropic subjects, the author concludes that myopia and myopic astigmatism are associated in general with a wider interpupillary distance, while in hypermetropia and hypermetropic astigmatism

the distance is often narrower. These relationships are found in both sexes, but the results are not invariable, as deviations from the rule are encountered not infrequently in all types of refractive error. (Bibliography.)

Park Lewis.

Pickard, Ransom. **A study of the central and peripheral light and dark adaptations with varying backgrounds.** Brit. Jour. Ophth., 1935, v. 19, Sept., p. 481.

The light threshold (the least amount of light seen on a black background) and the light difference (the least amount of black seen on a white background) are joined together by an infinite number of intermediate positions. This contribution is an inquiry into the least differences in either direction at intermediate points. The backgrounds used for the fields were: black velvet; 15 percent white; 76 percent white. The paper contains many tables and graphs illustrating the investigation by mathematical formulae. In the field test the object has a fixed proportional value, in the central test this is altered as adaptation progresses. D. F. Harbridge.

Possenti, G. **Contribution to the study of errors of refraction and their frequency.** Ann. di Ottal., 1935, v. 63, July, p. 494.

The author has made a study of the incidence and as far as determinable the causes of refractive errors as found during a period of ten years in his clinic at Puglia. He finds an increase of myopia of medium degree over hyperopia, and a tendency for medium to develop into higher degrees. He concludes that a predisposition to refractive defects is often an accompaniment of hereditary syphilis, endocrine disturbances, autointoxication and other constitutional defects. He reviews the literature exhaustively. (Bibliography.)

Park Lewis.

Puglisi-Duranti, G. **Clinical contribution to the knowledge of internal ophthalmoplegia.** Riv. Oto-Neuro-Oft., 1935, v. 12, March-April, pp. 256-283.

Two cases of internal ophthalmoplegia of luetic origin are reported. One was bilateral, of about two years duration in a man of 35 years. The paralysis had remained isolated in spite of lack of specific general treatment. The other case was one of right internal ophthalmoplegia of slow progress in a boy of fourteen years. A case is also reported of left internal ophthalmoplegia in a man forty years old affected by diabetes and high blood pressure. The first case is attributed to a nuclear and the second to a radicular lesion of vascular origin. (Bibliography.) M. Lombardo.

Riechert, T. **Syntropan as a mydriatic for diagnostic purposes.** Deut. med. Woch., 1935, No. 32, Aug. 9, p. 1278.

The author states that syntropan is a useful new mydriatic for diagnostic purposes. Its advantages are a shorter period of action than homatropin, and less influence on accommodation.

Theodore M. Shapira.

Sattler, C. H. **Experiences with contact glasses.** Klin. M. f. Augenh., 1935, v. 95, July, p. 33.

So far Sattler had ordered contact glasses for eighty patients, a greater part of whom wore them without distress the whole day, occasionally more than thirty hours. Patients with soft loose lids and corneal scars tolerated them comparatively well. Glasses of 8 mm. radius and 22 mm. diameter with tapering margins were most agreeable.

C. Zimmermann.

Tron, E. Z. **Optical basis of anisometropia and isometropia.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 481. (See Amer. Jour. Ophth., 1935, v. 18, June, p. 578.)

Vorisek, E. A. **Changes of the refraction in children with convergent strabismus.** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 820-826.

Zimkin, H. I. **Stability of accommodation.** Sovietskii Viestnik Ophth., 1935, v. 6, pt. 5, p. 720.

For determination of ability to do prolonged close work, determination of momentary accommodation is insufficient. The author describes a device for testing stability of accommodation, and describes the types of curve found,

some showing maximum accommodation maintained for twenty minutes, others an accommodation fatigue after one to two minutes of close work.

Ray K. Daily.

4. OCULAR MOVEMENTS

Agnello, F. **Chronic superior polioencephalitis with total external ophthalmoplegia in hereditary-lues.** Riv. Oto-Neuro-Oft., 1935, v. 12, March-April, pp. 241-255.

A man of twenty-four years, affected by recent symptoms of general asthenia and difficult phonation and deglutition, had for years had bilateral partial blepharoptosis, right external strabismus, and paralysis of all isolated and associated movements of both eyes. Accommodation and the consensual pupillary reflex persisted. The symptoms disappeared after specific treatment. The author concludes that the syndrome was due to primary atrophic degeneration of the grey matter of the medulla, giving the ophthalmoplegia first and then the labio-glosso-pharyngeal paralysis. (Bibliography.) M. Lombardo.

Bielschowsky, Alfred. **Congenital and acquired deficiencies of fusion.** Amer. Jour. Ophth., 1935, v. 18, Oct., pp. **925-937.**

Bossalino, Giuseppe. **Congenital monocular absence of lateral movement associated with paresis of the superior rectus of the opposite side and agenesis of the frontal sinuses.** Riv. Oto-Neuro-Oft., 1934, v. 11, Nov.-Dec., pp. 679-697.

A boy of seven years showed limited upward movement of the right eye and absence of outward movement of the left eye. In looking inward the left palpebral fissure became smaller than the right one and the eyeball retracted itself into the orbit. After discussion, the author concludes that the defect of movement had a muscular origin, that the retraction of the left eye in adduction was probably due to a deep insertion of internal rectus muscle or to a double insertion (one of the two acting as a retractor), and that the absence of strabismus in the left eye in its primary position was possibly due to an elastic cord replacing the lateral rectus muscle. He does not find any connection between the eye anomalies and the agenesis of the frontal sinuses. (Bibliography.) M. Lombardo.

Hicks, A. M., and Hosford, G. N. **Orthoptic treatment of squint.** Arch. of Ophth., 1935, v. 13, June, pp. 1026-1037.

The results obtained in a group of thirty-six patients, three to thirteen years of age, given orthoptic training over periods of two to nine months, indicate that such training is of no value in cases of anatomic abnormality, aniseikonia, or marked inequality of vision. Its value lies chiefly in developing fusion and is limited in straightening crossed eyes. In the remaining cases it is necessary to develop visual acuity in the squinting eye, to correct refractive errors, to break down suppression, and to correct false projection. (Discussion.) J. Hewitt Judd.

Ludvigh, E. J. **Concerning the relation between accommodation and convergence.** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 853-854.

McCool, J. L. **Modified recession operation with description of a new needle.** Trans. Western Ophth. Soc., 1st annual meeting, 1934, p. 26.

The author recommends placing the scleral sutures along a well defined line parallel to the old insertion of the tendon. He also favors separate sutures for closing the conjunctiva. The Gruss needle is recommended. (See Amer. Jour. Ophth., 1935, v. 18, p. 855.)

George N. Hosford.

Mengel, W. G. **Bilateral congenital deficiency of abduction with retraction (Duane syndrome).** Arch. of Ophth., 1935, v. 13, June, pp. 981-984.

An otherwise normal girl aged five years presented bilateral complete deficiency of abduction, with retraction of the globe and narrowing of the palpebral fissure during adduction, which was difficult. A convergence insufficiency was also present. (Photographs, bibliography, discussion).

J. Hewitt Judd.

Milner, J. G. **Some remarks on the recession operation for squint.** Brit. Jour. Ophth., 1935, v. 19, Aug., p. 448.

Recession of the internal rectus for convergent concomitant squint is discussed entirely from the operative side. A simple technique is given and the results in a series of fifty cases are compared with those in a number of cases operated upon at the Royal Westminster Ophthalmic hospital by other methods and by several surgeons.

D. F. Harbridge.

O'Connor, Roderic. **Tendon transplantation in ocular muscle paralysis.** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 813-820; also Trans. Western Ophth. Soc., 1934, first annual meeting, p. 81.

Pascal, J. I. **Does accommodation stimulate divergence?** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 851-853.

Peter, L. C. **Problems in heterophoria.** Trans. Western Ophth. Soc., 1st annual meeting, 1934, p. 17.

The author first defines a group of heterophorias associated with neurosis and for these he recommends medical and orthoptic treatment. They are usually variable and, if a state of relative stability can be attained by these measures, operative procedures are advised in carefully selected cases.

He next discusses the esophoria and exophoria of young individuals. For this group of cases he also recommends orthoptic training, but states that surgery may become necessary. He determines the type of operation to be used by a study of the deductions and their ratios, overaction suggesting recession and underaction a shortening type of operation.

George N. Hosford.

Verhoeff, F. H. **Cycloduction.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 208-228.

Verhoeff describes the apparatus and method used in a comprehensive study of this subject. He confirmed, with more accuracy, the experiments of previous workers. Among his conclusions are: Cycloduction is a normal function of the eyes. In ordinary vision cycloduction overcomes about half the slight exocyclotropia that usually exists when there are no stimuli to cycloduction, and it probably prevents the gradual development of serious torsional deviation.

C. Allen Dickey.

Vorisek, E. A. **Changes of the refraction in children with convergent strabismus.** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 820-826.

5. CONJUNCTIVA

Barker, L. F. **Parinaud's syndrome.** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 827-832.

Burnier, P., and Almeida, A. de. **Primary syphilis of the conjunctiva (occupational accident).** Arquivos do Instituto Penido Burnier, 1934, v. 3, Dec., pp. 219-222.

In the course of removal of adenoids, a young physician received some blood and saliva on his face. He developed a conjunctival lesion characterized by hypertrophy of the caruncle and the semilunar fold, with polyglandular swelling. The diagnosis was at first obscure, tularemia, tuberculosis, and Parinaud's being discussed. A month after appearance of the first symptoms a positive Wassermann and the presence of an erosion between the caruncle and the semilunar fold led to examination of a scraping which showed numerous spirochetes. By this time a secondary eruption had begun.

W. H. Crisp.

Chini, V., and Silvagni, M. **Some considerations on two cases of Parinaud's syndrome.** Riv. Oto-Neuro-Oft., 1935, v. 12, July-Aug., pp. 535-564.

A man thirty years old showed paralysis of upward movements only, right mydriasis, sluggish pupillary reaction to light, and no reaction to accommodation. A man of fifty-five years showed complete vertical paralysis and temporary absence of pupillary reflexes. From examination of other organs the author deduces that in the first case the symptoms were due to meningeal gliosis and in the other to vascular lesions of luetic nature. (Bibliography.)

M. Lombardo.

Colomba, Nicolo. **The tuberculous allergic condition and so-called phlyctenular keratoconjunctivitis.** Ann. di Ottal., 1935, v. 63, June, p. 437.

The author examined thirty-one subjects affected with phlyctenular keratoconjunctivitis. He made the intradermal tuberculin tests, complement fixation tests, and studies of tuberculous antigen in the urine. Radiograms were made of the thorax. The intradermal test was positive in thirty subjects, complement fixation in seven, and the antigen reaction in six. Radiograms demonstrated an active tuberculous process in seven subjects, while in twenty-four there was evidence of previous tuberculous infection. The author concludes that phlyctenular keratoconjunctivitis is an allergic phenomenon of tuberculosis. (Bibliography.) Park Lewis.

Dérer, Jozef. **Tuberculosis of the bulbar conjunctiva.** Bratislavske Lekarske Listy, 1935, v. 15, July, pp. 830-833.

The ulcerative type occurred in a woman of twenty-eight years, of tuberculous family. The lesion surrounded the iris, involved most of the bulbar conjunctiva, and invaded the lower lid. Several weeks later a tuberculous laryngo-pharyngitis developed, and after another four weeks the patient had violent and prolonged hemoptysis with rapidly fatal outcome. Since there had been no previous symptoms of general tuberculosis, the author suggests the possibility of primary ectogenous tuberculosis of the bulbar conjunctiva. (3 illustrations.) W. H. Crisp.

Dudinov, O. A. **Clinical symptoms and pathology of ocular involvement in lymphogranulomatosis.** Sovietskii Viestnik Ophth., 1935, v. 6, pt. 5, p. 642.

Massive involvement of the conjunctiva of one eye occurred in the form of chronic hyperplasia and marked folliculosis, clinically and histologically resembling Parinaud's conjunctivitis. The process extended into the cornea in the form of diffuse infiltrations and nodules. The patient, a woman of twenty-six years, suffered from intermittent fever, progressive cachexia, and general enlargement of the lymphatic glands. The diagnosis was confirmed at autopsy. Ray K. Daily.

Gifford, S. R., and Day, A. A. **Acute purulent conjunctivitis due to the meningococcus.** Arch. of Ophth., 1935, v. 13, June, pp. 1038-1041.

The authors review the literature and present the case of a boy aged seven years, who presented marked swelling of the lids, chemosis and congestion of the conjunctiva, profuse purulent discharge, and a large central erosion of the left cornea. The right eye was isolated by a protective shield and remained normal. Pure cultures of a gram-negative diplococcus were obtained. Fermentation tests and agglutination reactions were positive for the meningococcus. (Tables.)

J. Hewitt Judd.

Grolman, Gunther von. **A contribution to the surgical treatment of trachoma.** Arch. de Oft. de Buenos Aires, 1935, v. 10, April-May, p. 324.

Diathermy constitutes the surgical treatment of choice in trachoma. The scars are thin and do not contract, and cause neither entropion nor symblepharon. There are no hemorrhages, no shock. All newly formed tissues are destroyed rapidly and completely, and the operation may be repeated and the dosage graduated. M. Davidson.

Kankrov, A. L. **Swimming-pool conjunctivitis in Samarkand.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 5, p. 634.

Lack of sanitation in this region accounts for prevalence of swimming-pool conjunctivitis, which is frequently diagnosed as trachoma. These cases react badly to antitrachomatous therapy and do best on mild silver preparations, with cold applications of cyanide of mercury. Ray K. Daily.

Kogan-Abesgus, P. M. **Blood morphology in trachoma.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 463.

Blood studies of sixty-nine trachoma patients failed to reveal any characteristic deviation from the normal.

Ray K. Daily.

Livramento Prado, D. Dó. **Conjunctival syphilide.** Arch. de Oft. de Buenos Aires, 1935, v. 10, April-May, p. 247.

A case of a mucous patch of the bulbar conjunctiva in a girl of eighteen years is described and illustrated. Among 4,839 cases of lues treated at the Gaffree-Guinle dispensary (Santos, Brazil) from 1931 to 1933, with 225 cases of ocular lues, only five cases of conjunctival involvement are recorded.
M. Davidson.

Macht, D. I. **Phytopharmacological studies on the blood of trachoma patients.** Folia Ophth. Orientalia, 1934, v. 1, Sept.-Dec., pp. 358-365.

The term "phytopharmacology" is applied by the author to studies concerning the effects of various substances (drugs, poisons, toxins) on living plant protoplasm. Convenient for use are white lupin seedlings. The growth of the seedlings, and particularly of their roots, in normal plant-physiologic saline solution is compared with that in a like solution to which the substances to be tested have been added. The phytotoxic index is the ratio of growth to normal. As compared with readings of from 70 to 75 percent with the blood serum of normal individuals or of patients with nontrachomatous infections of the eye, the average phytotoxic index of sera from the one hundred cases of trachoma examined was 47.7 percent. (References.)
W. H. Crisp.

Markus, I. M. and Veiner, K. G. **Cytology of the conjunctiva in trachoma and follicular conjunctivitis.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 521.

From smears made in one hundred cases of trachoma and thirty-four of other types of conjunctivitis, the author concludes that cytologic studies are of value in differential diagnosis. Characteristic of trachoma are embryonal lymphoblasts, polymorphic in character, with vacuoles in the protoplasm, and nuclear mitosis; monocytes, histiocytes, neutrophiles, Humprecht's shadows, and epithelial cells with degenerative changes in the protoplasm and nuclei; as well as scarcity of eosinophiles and of plasma cells. Characteristic of follicular conjunctivitis are absence of lymphoblasts and Humprecht's shadow cells; lack of degenerative changes in the epithelial cells; scarcity of histiocytes and plasma cells; the predominance of lymphocytes; and the invariable presence of eosinophiles and monocytes. Ray K. Daily.

Massoud, Farid. **Trachoma as an endemic disease in Egypt.** Amer. Jour. Ophth., 1935, v. 18, Oct., pp. 952-955.

Mikaeljan, P. X. **The experience of the eye department of the First Medical Institute in Leningrad in preparation and organization of antitrachomatous squadrons in the Chuvash Republic.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 458.

The antitrachomatous work of the five-year plan consisted in establishment of trachoma stations supervised by special trained nurses, and in organization of short annual special courses in trachoma, using local material, for the local physicians. The program inaugurated in 1934 calls for ocular examination and follow-up treatment of the entire population. Ray K. Daily.

Stewart, F. H. **Prowazek-Halberstaedter body.** Giza Mem. Ophth., Lab., Eighth Annual Report. 1933, pp. 113-168.

This research work summarized in tables does not lend itself to abstracting. The origin of trachoma has not yet been solved. Prowazek-Halberstaedter bodies, defined as phagocytic vacuoles in epithelial cells, have resisted critical investigation. Stewart has advanced evidence to show that these bodies are formed by phagocytosis of bacteria which are not the cause of trachoma; although he thinks they may carry the virus of trachoma.
Lawrence Dunlap.

Szily, A. **Inoculation of chickens with trachomatous material.** Klin. M. f. Augenh., 1935, v. 94, June, p. 753. (Ill.)

The results coincided completely with Szily's former experiments on rabbits, in the formation of follicles

with inclination to create new germ centers. But clinical experience speaks against the identity of these experimental follicles with physiologic follicles in the conjunctiva and other parts of the body, or with trachoma follicles. With external similarity of histologic structure, they can be distinguished from ordinary follicles by their striking behavior as germ centers.

C. Zimmermann.

Thygeson, P., and Proctor, F. I. **The filtrability of trachoma virus.** Arch. of Ophth., 1935, v. 13, June, pp. 1018-1021.

Epithelial scrapings from patients with trachoma were found to contain a virus capable of passing through collodion filters impervious to conjunctival bacteria. Four inoculations of baboons with this bacteria-free filtrate produced the same type of follicular disease as produced by direct inoculation with trachomatous material.

J. Hewitt Judd.

Thygeson, P., Proctor, F. I., and Richards, P. **Etiologic significance of the elementary body in trachoma.** Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 811-813.

Wilson, R. P. **Blastomycosis of the conjunctiva.** Giza Mem. Ophth. Lab., Eighth Annual Report, 1933, pp. 76-79.

This case followed a scratch of the eye of a three-year-old female by a fowl. After removal of the tumor, the patient could not be traced. Diagnosis was made from pathologic sections.

Lawrence Dunlap.

Wilson, R. P. **Chronic unilateral gonococcal conjunctivitis.** Giza Mem. Ophth., Lab., Eighth Annual Report, 1933, pp. 82-83.

A healthy male aged twenty-three years appeared with a right ophthalmia of three months' duration. He also had a stage 3 trachoma, with smooth but marked cicatrization. The edematous right bulbar conjunctiva overlapped the cornea so that the latter appeared to be only about 5 mm. in diameter. The preauricular glands were enlarged and tender. A smear of conjunctival discharge showed almost a pure culture of gonococci, both extracellular and intracellular. Under one percent silver nitrate, potassium permanganate, and six milk injections, the patient left the hospital in one month, but he was not discharge-free for several more weeks, and gonococci were present four months after the original attack.

Lawrence Dunlap.

Wilson, R. P. **Schistosomiasis of the conjunctiva.** Giza Mem. Ophth. Lab., Eighth Annual Report, 1933, pp. 79-82.

The second case of this condition ever recorded in Egypt is reported in detail and photomicrographs are given. The tumor was diagnosed as granuloma and was removed before the correct diagnosis was made from typical bilharzial ova with terminal spines (S. hematobium) surrounded by large giant cells, lymphocytes, and plasma cells. Lawrence Dunlap.

Wilson, R. P. **Spring catarrh.** Giza Mem. Ophth. Lab., Eighth Annual Report, 1933, pp. 103-105.

In 1932, 675 cases of spring catarrh were seen in Egyptian Government ophthalmic hospitals. It is commoner in males (4:1). Especially the younger patients almost always present a peculiar sallow, anemic appearance. After exposing the conjunctiva to the air for a minute or two, a thin glistening membrane may be stripped off, which Wilson considers pathognomonic. Under the corneal microscope the surface of the cornea appears as if it had been dusted with flour (keratitis epithelialis vernalis). Epithelial cell edema is present and there may be actual vesicles, best observed in the upper half of the cornea. Eosinophile cells in the conjunctival scrapings aid in diagnosis. Chaulmoogra oil is a valuable remedy for trachoma mixed with spring catarrh. Lawrence Dunlap.

Wilson, R. P. **Trachoma studies.** Giza Mem. Ophth. Lab., Eighth Annual Report, 1933, pp. 96-103.

The author quotes McCartney and Mayou to the effect that trachoma does not supervene on a normal conjunctiva but some antecedent inflammatory re-

action is necessary. Of 456 Egyptian children only one over eighteen months of age was free from trachoma. In the ophthalmic survey of Bahtim village in 1929, all children over one year old were affected with trachoma. Four out of five children treated daily from birth with 0.5 percent zinc sulphate and 0.01 percent mercury pyoctannate were free from trachoma at the end of one year's treatment. Very dilute silver nitrate drops are also giving encouraging results. Lawrence Dunlap.

Wilson, R. P. **Xerophthalmia.** Giza Mem. Ophth. Lab., Eighth Annual Report, 1933, pp. 105-108.

In Egypt, xerosis existed in eighteen percent of all cases of parasitic disease. Out of thirty-three cases, only six complained of night blindness. Vitamin A was given but results are still uncertain. Local treatment of corneal xerosis spots was most successful by the Tobgy method; that is, after cocainization, scraping off the deposits, touching with pure phenol, irrigating, and applying noviform ointment and bandage. The eye was quiet in five to seven days, with no recurrences noted after three years. Lawrence Dunlap.

Zykulenko. **Removal of the meibomian tarsal glands in "latent" trachoma.** Folia Ophth. Orientalia, 1934, v. 1, Sept.-Dec., pp. 366-373.

After apparent healing of conjunctival trachoma, an exacerbation may produce corneal trachoma. Such exacerbations are regarded by the author as due to infection of the meibomian glands. In recent cases of trachoma he recommends that after the acute conjunctival disturbance has subsided the eyelid shall be split and the meibomian glands destroyed with a small curette. Splitting of the cartilage should be done under control with a binocular loupe, and the pressure of the curette should be diminished as the lid margin is approached, as it is important not to expose the roots of the cilia.

W. H. Crisp.

6. CORNEA AND SCLERA

Brecher, I. **A new way of treating hereditary luetic parenchymatous keratitis (by autohemotherapy according to Schieck).** Klin. M. f. Augenh., 1935, v. 95, July, p. 83.

Three cases are reported with favorable results from injections of the patient's own blood into the anterior chamber. The healing process in each was essentially shortened, and in one case the outbreak of an already imminent keratitis in the other eye was prevented or suppressed.

C. Zimmermann.

Dimissianos, B. **Tuberculogenic epithelial keratitis.** Arch. d'Opht., 1935, v. 52, July, p. 499.

Superficial tuberculosis of the cornea is very rare. A woman aged thirty-nine years, with a family and marital history of tuberculosis, had hemoptysis, pleurisy and bronchitis four years before her left eye became affected. The right was normal. There was not much sign of irritation in the left eye, but examination of the cornea showed superficial flat white plaques radiating from the center. These looked like tendons and suggested the name of "tendinous keratitis". In addition, scattered throughout the epithelium were many small irregular plaques, some confluent, with vertical stripes of transparent tissue between. Fluorescein accentuated the picture. Corneal sensitivity was not reduced. There was no vascularization of the cornea. (Illustrations.)

Derrick Vail.

Friede, Reinhard. **A keratoplastic operation according to Morax.** Arch. f. Augenh., 1935, v. 109, July, p. 243.

A twenty-two-year-old girl suffered from chronic conjunctivitis with a resulting round leukoma three mm. in diameter at the center of the cornea. Somewhat modifying the technique of Morax, the author lanced the anterior chamber at the lower limbus and introduced a thick black celluloid plate to guard the iris and the lens from damage. He then trephined the central clouded portion and a clear portion at the periphery of the same cornea, and exchanged the discs, holding the discs in place by threads anchored at several places in the conjunctiva. The trans-

plant in the center healed and remained transparent; the peripheral disc became more opaque. The author thinks better results could be gained if the peripheral hole were left to heal by granulation. R. Grunfeld.

Gallenga, Riccardo. **The importance of osmotic pressure in absorption of medicinal solutions through the cornea.** Rassegna Ital. d'Ottal., 1935, v. 4, May-June, p. 426.

This is a reply to Italo Simon, who stated (Archives Internationales de Pharmacodynamie et de Therapie, 1935, v. 50, pt. 2, p. 180) that the previously published work of Gallenga (American Journal of Ophthalmology, 1933, volume 16, page 173) could not be substantiated. Eugene M. Blake.

Kirwan, E. W. O'G. **Epidemic superficial punctate keratitis in Bengal.** Folia Ophth. Orientalia, 1934, v. 1, Sept.-Dec., pp. 345-357.

The paper is based on 1512 cases of epidemic keratitis seen in Calcutta during the rainy period. The above title, applied to this condition by Fuchs, is not altogether satisfactory, in that the keratitis is frequently deep and in many cases is accompanied by mild iridocyclitis. Severe cases showed enlargement of the preauricular gland. In some of the severe cases there were complications in the form of permanent corneal opacities or interstitial keratitis. The bacterial findings were negative. There were no inclusions. Inoculations with scrapings of corneal epithelium failed in the lower animals but were successful on healthy human cornea. (References, 8 color illustrations.)
W. H. Crisp.

Moniukova, H. K. **Cystic degeneration of the posterior corneal surface.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 552.

A cyst in the posterior portion of the cornea communicates with the anterior chamber. The patient had symptoms of Basedow's disease, and the author attributes the corneal cyst to a nutritional disturbance of endocrine etiology.
Ray K. Daily.

Németh, L. **Lattice-shaped degeneration of the cornea.** Klin. M. f. Augenh., 1935, v. 95, July, p. 73.

Brother and sister showed on both eyes a dominant-hereditary progressive lattice-shaped degeneration of the cornea, and the father suffered from a similar affection. Both children of the brother, aged six and five years, had relapsing corneal erosions. This might be interpreted as endogenous weakness of the corneal tissue which, beginning at an early age, leads later to lattice-shaped degeneration.
C. Zimmermann.

Nizetić, Zdravko. **Denig's operation in trachomatous pannus.** Klin. M.f. Augenh., 1935, v. 95, July, p. 69. (Ill.)

The author substituted Derkač's method of transplantation of epidermis for oral mucous membrane, and after two weeks began to smooth down the transplant by repeated cauterization, converting it into a firm scar, with good cosmetic effect. C. Zimmermann.

Nizetić, Zdravko. **The technique of corneal transplantation.** Klin. M. f. Augenh., 1935, v. 94, June, p. 801. (Ill.)

A sliding catch is attached to the knife previously described (American Journal of Ophthalmology, 1934, volume 17, page 1077) to avoid possible injury of the iris or lens.
C. Zimmermann.

Pajtas, J. **Recurrent corneal herpes after inoculation with Ponndorf's vaccine A.** Bratislavske Lekarske Listy, 1935, v. 15, Sept., pp. 1048-1053.

For three years the author has systematically subjected herpetic patients to intracutaneous inoculation with this vaccine. One case had an intercurrent relapse, and in a second case the relapse came shortly after the treatment. The author believes that introduction of the foreign substance into the organism causes a disturbance of acidobasic equilibrium, leading to anaphylactic shock and an attack of herpes. He is convinced of the endogenous origin of herpes and of its association with an allergic diathesis. W. H. Crisp.

Paschen, E. **Neurolapine and corneal metastasis.** Schweiz. med. Woch., 1935, no. 23, June 8, p. 542.

Since 1929 Paschen has vaccinated 97 rabbits with neurolapine. In 22 rabbits, corneal lesions appeared; in 16 cases between the seventh and ninth days. The author shows by pathologic studies of these corneas that he is dealing with a genuine vaccinia.

Theodore M. Shapira.

Queiroz, L. de S. **Conjunctival flap.** Arquivos do Instituto Penido Burnier, 1934, v. 3, Dec., pp. 197-203.

The various types of flap are clearly described (in Portuguese) and illustrated. Particularly good results were obtained in cases of corneal ulcer secondary to severe infectious conjunctivitis (acute catarrhal, gonococcic, and diphtheric). (References, 10 illustrations.) W. H. Crisp.

Rocha, J. M. **Iontophoresis with zinc in keratitis.** Arquivos do Instituto Penido Burnier, 1934, v. 3, Dec., pp. 211-213.

The necessary corneal anesthesia is regarded by the author as without danger. The procedure is used in traumatic and serpiginous ulcers of the cornea, in herpetic and dendritic keratitis, and in infected wounds. Ten cases are reported. (References.) W. H. Crisp.

Rokitskaja, L. **Etiology and pathogensis of herpes zoster ophthalmicus.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 453.

The author reports a rare case of herpes zoster complicated with disciform keratitis in a man of twenty-one years, a case of herpes zoster complicated by superficial punctate keratitis in the patient's sister twenty-six years of age, and a case of chicken pox in their two-year-old niece. The author cites the familial involvement as proof of the contagiousness of the disease.

Ray K. Daily.

Stallard, H. B. **A knife for corneal grafting.** Brit. Jour. Ophth., 1935, v. 19, Aug., p. 459.

For shelving the corneal opening the author has devised a knife with a blade 1.5 mm. long and 1 mm. deep set at a right angle to the shaft. The cutting edge is on the upper side of the blade and the upper half of the rounded extremity is sharpened.

D. F. Harbridge.

Stastnik, E. **Pathology and therapy of episcleritis periodica fugax.** Klin. M. f. Augenh., 1935, v. 95, July, p. 80.

From clinical study of three cases the author concludes that this affection is an allergic disease, caused by disturbed function of liver or pancreas, with a certain affinity for the eye. Accordingly the therapy was nonspecific desensitization. Every second day a five percent solution of peptone was injected intradermically and 10 c.c. of a 20-percent solution of sodium thiosulphate intravenously in series of twenty injections, combined internally with calcium and Carlsbad water. Considerable improvement was obtained. C. Zimmermann.

Sugita, Y., and Sugita, S. **The change in histochemical reaction in the pathologic cornea.** Graefe's Arch., 1935, v. 134, p. 175.

In experimental keratitis in rabbits, the acid substances produced by the inflammation neutralized the normal strongly alkaline reaction of the corneal lamellae and led to a neutral or weakly acid reaction; as demonstrated by the inflamed corneal stroma coloring blue with methylene blue and red with pyronin, and also by investigation of the H-ions and other examinations. Such a change in histochemical reaction can excite disturbance in the transparently dissolved colloidal albuminous particles when the reaction is alkaline and thus cause precipitation of these particles, with corneal haziness such as accompanies inflammations.

H. D. Lamb.

Szekely, Josef. **Keratitis nummularis Dimmer.** Graefe's Arch., 1935, v. 134, p. 184.

In a 28-year-old agricultural worker, numerous foci of keratitis nummularis ocurred in the left eye, and involvement of the right eye began about seven months later. In the left eye, the opa-

cities accompanying the foci near the corneal center later fused into a large irregularly shaped opacity with extensive but superficial loss of substance. In the right eye, the majority of the foci presented superficial loss of substance and several a definite ulceration. In a woman of 58 years the right eye alone developed the typical clinical picture of keratitis nummularis from a keratitis vesiculosa. The author argues that keratitis superficialis punctata and keratitis nummularis have pretty much the same origin. The left eye of a 38-year-old paper hanger developed typical keratitis disciformis from very minute blisters resembling the picture of keratitis vesiculosa.

H. D. Lamb.

Venco, Luigi. **Ocular neuroparalytic syndrome in surgical lesions of the trigeminus.** Riv. Oto-Neuro-Oft., 1934, v. 11, Nov.-Dec., pp. 616-644.

After injection of 2 c.c. of absolute alcohol into the right gasserian ganglion for treatment of neuralgic attacks in the right temporal and zygomatic regions, a man of seventy-three years showed loss of palpebral, conjunctival, and corneal sensibility, and diffuse opacity of the whole cornea with bullous keratitis. Total tarsorrhaphy was followed by improvement of the degenerative corneal symptoms. (Bibliography.) M. Lombardo.

Visalli, Felice. **Paralytic lagophthalmos is not sufficient to produce corneal ulcers.** Riv. Oto-Neuro-Oft., 1934, v. 11, Nov.-Dec., pp. 698-706.

From study of 130 cases of facial paralysis the author states that keratitis cannot develop from the concomitant lagophthalmos, but results from trophic disturbance due to a trigeminal lesion. To substantiate his theory he reports three cases of facial paralysis with corneal ulcer, two in women of fifty-six and twenty-one years respectively, affected by tumor of the cerebello-pentine angle, and one in a man of twenty years affected by luetic meningitis involving the trigeminus. (Bibliography.)

M. Lombardo.

Wilson, R. P. **Further notes on the platinum chloride method of corneal tattooing.** Giza Mem. Ophth. Lab., eighth annual report, 1933, pp. 108-111.

The author still thinks the Krautbauer method is the best, as the platinum dust forms a thin uniform superficial black layer under a normal corneal epithelium (see fifth annual report, page 97). Failure is ascribed to old hydrazin hydrate solutions, a rough palpebral conjunctiva, careless scraping of corneal epithelium and failure to keep the patient at rest postoperatively.

Lawrence Dunlap.

Wilson, R. P. **Xerophthalmia.** Giza Mem. Ophth. Lab., eighth annual report, 1933, pp. 105-108. (See Section 5, Conjunctiva.)

7. UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Andrade, A. L. de. **The inflammatory reaction caused by phosphatides and its relation to sympathetic ophthalmia.** Arch. f. Augenh., 1935, v. 109, July, p. 235.

The author disproves the assertion made by Guillery that the pathologic changes in sympathetic ophthalmia are of tuberculotoxic origin. (See Guillery, below.) De Andrade produced similar changes with different kinds of phosphatides, including phytin (a vegetable phosphatide), cholesterin, and lecithin. Thus other agents beside tuberculotoxin produce granulation tissue consisting of lymphocytes, epithelioid cells, and giant cells. R. Grunfeld.

Barroso, C. F. **Tuberculous iritis.** Rev. Cubana de Oto-Neuro-Oft., 1935, v. 4, March-April, p. 35.

The author distinguishes between a local tuberculosis due to direct invasion by Koch's bacillus, and for which the treatment is often only surgical, and iritis due to toxins from tuberculosis elsewhere. The latter is a medical iritis, to be treated with tuberculin, gold, and methylic antigen. M. Davidson.

Böck, J. **A case of hematopoietic marrow in heteroplastic bone in an atrophic eye, and remarks on necropsy find-**

ings in chronic uveitis. Zeit. f. Augenh., 1935, v. 86, July, p. 257.

Clinical and necropsy findings are described in a case of hematogenously spreading tuberculosis with ocular involvement. A severe iridocyclitis with bone formation developed in one eye. Striking was the unusual amount of actively hematopoietic marrow in the heterotopic bone. As a stimulus for this unusual occurrence, one must consider the secondary erythrocytosis and the high-grade hypoxemia in severe hematogenous emphysematous tuberculosis.

F. Herbert Haessler.

Goldmann, H., and Buschke, W. **The blood-aqueous barrier and vitamin C.** Arch. f. Augenh., 1935, v. 109, July, p. 205.

The authors prove the existence of a blood-aqueous barrier which inhibits diffusion of vitamin C from the aqueous. The permeability of this barrier can be measured by the velocity at which fluorescein appears in the aqueous. A subconjunctival injection of sodium chloride increases the permeability and thus decreases the vitaman-C content of the aqueous, but simultaneous administration of adrenalin will frustrate this change in permeability. Intramuscular injection of theophyllin also increases the permeability. Since decrease of vitamin-C content of the aqueous is deleterious to the lens, any pathology which tends to increase the permeability of the barrier will lead to lens changes. This may explain the occurrence of cataract in uveitis.

R. Grunfeld.

Guillery, H. **A simple procedure to prove the tuberculotoxic origin of sympathetic ophthalmia.** Arch. f. Augenh., 1935, v. 109, July, p. 139.

The author claims that he was able to produce the characteristic histologic picture of sympathetic ophthalmia by implantation of tubercle bacilli enclosed in a sack of reed fibers into the vitreous of a rabbit's eye, so that only the toxins liberated from the bacilli could be effective. He achieved similar results with intravenous injections of a phosphatide derived from tubercle bacilli by Anderson. He concludes that sympathetic ophthalmia is of tuberculotoxic origin. In his present experiments he traumatized a rabbit's eye by carrying a thread through the cornea and sclera, and he injected intravenously every second day from 0.01 to 0.2 c.c. of Koch's bacillary emulsion, altogether twenty injections in forty days. At autopsy ninety days later the eye showed massive infiltration with lymphocytes, plasma cells, and epithelioid cells in the large-vessel layer of the choroid. Only if the eye was more severely injured and a chronic state of inflammation resulted did the nontraumatized eye show a similar histologic picture.

R. Grunfeld.

Kyrieleis, W. **Myotony, myotonic dystrophy, and pupillotony.** Münch. med. Woch., 1935, v. 82, July 5, pp. 1067-69.

Congenital myotony or Thomsen's disease and myotonic dystrophy have in common an increased mechanic irritability of striped muscles, in the first instance associated with hypertrophy of the muscle, in the latter with atrophy. Among the eye muscles the most frequently affected is the orbicularis. Advanced dystrophy is almost always associated with so-called myotonic cataract. In pupillotony, which has a central nervous origin, the affected pupil is practically fixed to light and responds with a slow but excessive contraction of long duration to convergence. While the Argyll Robertson phenomenon is usually bilateral, accompanied by miosis, characterized by a quick and often excessive convergence reaction, and influenced with difficulty by mydriatics, pupillotony is usually unilateral, with wide pupil convergence reaction very slow although excessive, and a prompt and maximal reaction to mydriatics.

Bertha Klien.

Lanou, W. W. **Bacillus pyocyaneus infection of the eye.** Amer. Jour. Ophth., 1935, v. 18, Oct., pp. 950-952.

Meller, J. I. **Schnabel and his position in regard to sympathetic ophthalmia.**

Wien. med. Woch., 1935, no. 33, Aug. 10, p. 893.

After quoting Schnabel at length, and admitting that nothing definite can be said about the etiology of sympathetic ophthalmia, Meller says that it is necessary to work from the standpoint of a tuberculous infection, as proved by him in some of his cases.

Theodore M. Shapira.

Pokrovskii, A. I. **Occlusion of the pupil.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 5, p. 631.

During iridectomy for sympathetic ophthalmia, in a young man of twenty-six years, the membrane occluding the pupil was pulled upward by its attachment to the iris, leaving a clear pupil. It was apparently not bound down to the lens. Ray K. Daily.

Terry, T. L. **Angioid streaks and osteitis deformans.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 555-573.

From a study of five cases the author suggests that angioid streaks and osteitis deformans may be local manifestations of a generalized disease. While arteriosclerosis is an important factor in the production of the streaks, mere physical contraction of the choroid can produce folds which are similar in pattern. C. Allen Dickey.

Urrets Zavalia, A., and Obregon Oliva, R. **Angioid streaks in the fundus.** Arch. de Oft. de Buenos Aires, 1935, v. 10, April-May, p. 223.

A review of the literature, revealing only seventy cases published since Doyne's first case in 1889, indicates the rarity of the affection. The author agrees with Grönblad's conception of the disease as an hereditary dystrophy of elastic tissue. The similarity of the streaks to vessels is too remote and the evidence for lack of relation to vessels is too strong to justify the term "angioid", and most observers agree that they are situated not in the retina but in the lamina vitrea of the choroid. The case observed and illustrated was bilateral, in a male of thirty-seven years. In addition to the peripapillary network from which radiated sinuous irregular reddish streaks with frayed borders, one to three diameters of the larger retinal veins in width, the whole peripapillary zone as far as the equator, excepting the posterior pole, was cloudy and of a yellowish-pink color and flecked with pigment like that of the streaks. The latter appeared only after five months of observation and are therefore regarded as belonging to the later stages. Involvement of the macula appeared late and looked like a degenerative myopic or senile change. This progressed with hemorrhagic spots and exudates which after absorption left a picture similar to that of a hole in the macula. The patient's two children exhibited diffuse bilateral pigmentary chorioretinal changes.

M. Davidson.

Valenti, Giulio. **Treatment of keratohypopyon.** Rassegna Ital. di Ottal., 1935, v. 4, May-June, p. 415.

Valenti reports excellent results in the treatment of keratohypopyon with a German preparation called "Protinal, A and B." The formula "A" consists of milk albumen and strychnine. "B" contains the milk albumen with strychnine and arsenic in organic combination, and its use is confined to the more severe cases. The drug is used by injection daily or every other day for twelve doses. Eugene M. Blake.

8. GLAUCOMA AND OCULAR TENSION

Cattaneo, D. **Clinical, anatomical and bacteriological contributions to the study of late infections after antiglaucomatous fistulizing operations.** Ann. di Ottal., 1935, v. 63, July, p. 481.

A case of secondary glaucoma had been operated on eighteen years before by scleral trephining with peripheral iridectomy. A diplococcic infection found entry through the operative scar, and an annular corneal abscess developed. The author discusses the records of like cases. While the potential danger of infection through a channel covered only by the conjunctiva cannot be overlooked, he concludes with Butler and Elschnig, both of whom af-

ter discarding trephining returned to it, that in certain cases neither iridectomy nor cyclodialysis promises equally favorable results. (One plate, bibliography.) Park Lewis.

Diaz Dominguez, D. **Iris implantation in glaucoma.** Arch. de Oft. de Buenos Aires, 1935, v. 10, June, p. 375.

A modified iridencleisis has been practiced by the author since 1931 and was described by him in 1932 (see Amer. Jour. Ophth., 1932, v. 15, p. 998). His experience in thirty-eight cases is summarized. Postoperative iritis was observed twice. Blocking of the fistula by anterior luxation of the lens which became opaque was noted once. Hemorrhage into the anterior chamber five days after operation with resulting absolute glaucoma occurred once. No late infection has been noted. Twenty cases have been under observation four months or more, and eleven over a year. The results in fourteen out of the twenty cases are considered good, with a permanent tension of less than 25 mm.; three fair with tension between 25 and 30 mm.; and three bad, with tension above 30 mm. Hypotony is not considered a disadvantage, and cataract is not considered as favored by hypotony. The author's operation is recommended in chronic glaucoma, and in the majority of cases of acute glaucoma.

M. Davidson.

Duke-Elder, Stewart. **The vitreous body and glaucoma.** Brit. Jour. Ophth., 1935, v. 19, Aug., p. 433.

The chemical and physical properties and behavior of the vitreous body were studied to test the theory that swelling of the vitreous body causes the raised intraocular pressure in primary chronic glaucoma. No increase in hydration was obtained on treatment of the vitreous body with solutions of sodium oleate and laurate, or by changing the p_H to the alkaline side of normality. Treatment with K_2SO_4, KCNS, or dilute HCl decreases the stability of the gel structure. Attempts at peptisation of the vitreous proteins were unsuccessful. The theoretical implications in the theory of vitreous swelling are discussed, and a mechanism whereby it may occur is suggested. Goedbloed's denial of the gel nature of the vitreous body is controverted.

D. F. Harbridge.

Hamburger, Carl. **Experiences with glaucosan.** Brit. Jour. Ophth., 1935, v. 19, Aug., p. 455.

The author asserts that glaucosan is an incomparable pupil-enlarging and pressure-reducing agent, particularly valuable in severe iritis and secondary glaucoma. Its effects are of rather short duration. It will not render operation superfluous. D. F. Harbridge.

Hardesty, J. F. **Control of intraocular hypertension by systemic medication.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 497-521.

Subcutaneous or intramuscular injection of 4 to 8 minims of adrenalin solution, or oral administration of ⅜ grain of ephedrin resulted in lowering of tension, if used early in the course of the disease. Their action is assumed to be through the autonomic nervous system. Some theories of glaucoma are reviewed. C. Allen Dickey.

Poos, F. **Results of further investigation and important comments on artificial softening of the eyeball.** Arch. f. Augenh., 1935, v. 109, July, p. 162.

The author demonstrated production of a long-continued hypotonic state of the globe when, by either disease, trauma, or medical or surgical interference, the circulatory system was so damaged that the capillaries became paralyzed. The degree of absorption then surpassed the production of aqueous. No distinction is to be made between pharmacodynamic and osmotic hypotony, since the hypotony is produced by the toxic effect of the drug upon the capillaries, and not by pharmacologic action. R. Grunfeld.

Theobald, G. D. **Schlemm's canal: its anastomoses and anatomic relations.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 574-595. (See Section 19, Anatomy and embryology.)

Wurdemann, H. V. **Adolescent glau-**

coma. Trans. Western Ophth. Soc., 1st annual meeting, 1934, p. 67.

The author reports six cases of glaucoma in patients under thirty years of age which were seen during a period of 45 years. Three of the six were treated bilaterally with Elliot trephinings with satisfactory results. In five of the six cases there was progressive myopia, and in one lessening of hyperopia, with contraction of the visual fields and production of glaucomatous cupping but without any of the signs of anterior or medial glaucoma. The author believes that all of these cases were due to a local posterior stoppage of circulation.

George N. Hosford.

9. CRYSTALLINE LENS

Bellows, J. G. **The biochemistry of the lens. 4. The origin of pigment in the lens.** Arch. of Ophth., 1935, v. 14, July, pp. 99-107.

The presence of basic proteins (histone and protamin) in the lens was demonstrated experimentally. The protamin extracted from the lens reacts with cystein to produce a black pigment supporting the theoretic protamin and cystein reaction in melanogenesis. The possible origin of the yellow color in nuclear sclerosis of the lens is considered. The nuclei of lens fibers disappear in the center of the lens, freeing protamin from the nucleoproteins. This central region has a state of alkalinity which provides a suitable medium for the protamin-cystein reaction, and consequent development of a yellow lenticular color. A brown or black cataract is formed by a greater amount of sclerosis taking place, setting free more protamin, which in turn produces excess of pigment. J. Hewitt Judd.

Dimshitz, L. A., and Mikaeljan, P. X. **Dark adaptation in aphakia.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 4, p. 440.

After combined cataract extraction, twenty-one aphakic eyes of fourteen patients were examined with the Nagel adaptometer with and without correction. The tabulated results show that aphakia per se does not disturb dark adaptation, and that the function is independent of visual acuity.

Ray K. Daily.

Nakamura, B., and Nakamura, O. **Vitamin C in the lens and aqueous humor of human eyes with cataract.** Graefe's Arch., 1935, v. 134 p. 197.

Using the Kotake-Nishigaki method, it was found that vitamin C was generally considerably diminished in the lens and aqueous humor of eyes with senile, complicated, or traumatic cataract, as well as in the aqueous humor of eyes with various disorders (glaucoma, retinitis pigmentosa, secondary glaucoma, chronic uveitis, hydrophthalmos) which are frequently followed by complicated cataract. H. D. Lamb.

Schmerl, E. **The theory of cataract formation.** Folia Ophth. Orientalia, 1934, v. 1, Sept.-Dec., pp. 391-398.

The author, who studied the sodium nitro-prussidian reaction of the lens in various vertebrates, describes a stage of the lens in which the reaction is no longer present. A second investigation showed that normal lens substance had the power of bleaching the brown nuclear substance of cataractous lenses. The author believes that the primary basis of cataract formation is damage to the lens capsule with incidental metabolic changes. (References.)

W. H. Crisp.

Schnyder, W. **Cataract in childhood with simultaneous appearance of poikilodermia atrophicans.** Schweiz. med. Woch., 1935, no. 32, Aug. 10, p. 719.

In a boy of four and a half years the parents noticed decrease in vision and grayish color of pupils. Eight years previously the boy's oldest sister had been operated on for cataract in both eyes. Both children showed typical skin symptoms, and the boy showed absence of the testicles. Both of the boy's lenses were swollen, and in the region of the posterior pole were star-shaped opacities. Theodore M. Shapira.

Trovati, E. **Physico-chemical constants of the blood and senile cataract.** Ann. di Ottal., 1935, v. 63, Aug., p. 598.

In thirty persons having senile cataract the author attempted to determine the physicochemical constant experi-

mentally by a study of the blood. She found as to blood morphology a relative reduction in cell count, normal chromometric value, increased color index, slight increase of granulocytes, slight retardation in the coagulation time, normal rapidity of sedimentation, slight increase in resistance to hemolysis, and augmentation of the viscosity. Blood pressure was increased in relation to age, there was moderate increase in the uric acid content, the glycemic value was diminished, cholesterin somewhat high, potassium relatively high, calcium low, acidosis slight, Wassermann and Kahn reactions weakly positive in 8 per cent, positive in 1.8 per cent, and negative in 84 per cent of the cases. The author relates the problem of senile cataract to calcium and potassium metabolism as well as to modifications of ionicosaline isoequilibrium. (Bibliography.) Park Lewis.

10. RETINA AND VITREOUS

Bracci-Torsi, H. **The content of ascorbic acid (vitamin C) in the retina and suprarenals of animals.** (Experimental research.) Arch. di Ottal., 1935, v. 42, March-April, p. 80.

The experiments show the presence of ascorbic acid in the retina as well as in other ocular tissues and fluids. Beef and pig eyes were used in the experiments. No relationship was found between the quantity of ascorbic acid present in the retina and in the cortex of the suprarenal glands. The author is investigating the presence of ascorbic acid in retinas having only cones and in those having only rods, with the idea that presence or absence of ascorbic acid may offer some explanation of day and night blindness. H. D. Scarney.

Castelli, A. **Contribution to the study of angioneurotic disturbances of the retina.** Ann. di Ottal., 1935, v. 63, Aug., p. 561.

The author reports four cases of angioneurotic disturbance. Three were in women suffering from ovarian disorders and in whom the ocular symptoms disappeared after exhibition of follicular extract or of whole ovarian substance. In two cases the use of acetylcholin at the beginning of the treatment caused marked disturbance in the retinal circulation. In one instance a valuable pharmacodynamic effect was produced with adrenalin, locating a selective ocular focal center at a distant point. The author discusses in detail the anamnesic and clinical points of the cases presented, together with the etiologic and pathologic mechanisms involved. Pathogenically he regards the angiospasm as a symptom of a complex in which there is special susceptibility on the part of the retinal circulation in connection with regulation of the peripheral circulation. (Bibliography.)
Park Lewis.

Charamis, J. **Late results of the most recent operative methods in retinal detachment.** Folia Ophth. Orientalia, 1934, v. 1, Sept.-Dec., pp. 404-412.

Six cases are reported. Of three operated on by Sourdille's method, two gave satisfactory results, while in the third the detachment became complete. In one case Gonin's method was used unsuccessfully. None of these patients had more than a moderate myopia, while five of them had retinal tears.
W. H. Crisp.

Goedbloed, J. **Studies on the vitreous, 3 and 4.** Graefe's Arch., 1935, v. 134, p. 146.

The vitreous shows increase of volume in water, in solutions with only a trace of neutral salts, and in solutions of alcohol up to 60 per cent, when the solutions are constantly renewed and after prolonged immersion. With hydrogels the increase in volume would be due to raising the load and to hydration of the gel micellae. In the vitreous it is exclusively produced through an increase in the charge of the filaments. Increase in volume of the vitreous does not produce increase of pressure measurable as in a hydrogel.

By tonus of the vitreous is meant the hydrostatic pressure of the vitreous humor when production and removal of vitreous are balanced. The author claims to prove that the amount of tonus must be dependent not only upon the

measure of this production and removal but also upon the resistance to the flow of vitreous humor in the vitreous network. H. D. Lamb.

Gradle, H. S. **A simple needle for diathermy treatment of retinal detachment.** Amer. Jour. Ophth., 1935, v. 18, Oct., p. 956.

Hippel, E. **Perivasculitis retinae (recurrent vitreous hemorrhages in youth).** Graefe's Arch., 1935, v. 134, p. 121.

In answer to Merchesani's recent conclusion that perivasculitis retinae is only a local symptom of thromboangiitis obliterans (Buerger), the author reviews the arguments for its tuberculous origin. The condition usually occurs in eyes that present elsewhere definite tuberculous changes. In a 27-year-old male patient in whom enucleation was necessary because of secondary glaucoma, histologic examination of the perivascular infiltration of several retinal veins showed epithelioid, giant, and round cells. H. D. Lamb.

Marchesini, E. **The behavior of the retinal arterial pressure in relation to the general circulation and to some ocular affections.** Ann. di Ottal., 1935, v. 63, July, p. 532, and Aug., p. 621.

From observations in 54 cases of systemic pressure and of that of the retinal arteries, and of the visual acuity under the action of acetylcholin, the author arrives at the following conclusions: In those normal subjects without refractive errors and with the vascular system intact, acetylcholin produces slight lowering of the systolic and diastolic retinal pressure with small increase in visual acuity (2 percent). In those who have hypertension and ocular maladies dependent upon it there is little diminution of retinal arterial pressure and there is no increase in visual acuity. In those who have descending optic atrophy but normal retinal vessels, or with the papillary vessels normal while the retinal pressure is lowered, the author has seen no increase of visual acuity. In subjects with retinal pigmentary degenerative changes, with retrobulbar neuritis, or with retinal angiospasm, there was relative retinal hypertension from marked diminution of the retinal pressure due to the action of the acetylcholin. Pari passu in these affections the visual acuity has been raised. (Bibliography.) Park Lewis.

Putschar, W. **Concerning angiomatosis of the retina and the central nervous system, with special consideration of simultaneous findings in the pancreas.** Münch. med. Woch., 1935, v. 82, July 5, pp. 1084-88.

In seven cases of cerebellar angiomatosis cystic tumors, solid adenomas and fibroadenomas of the pancreas were found, some of them only microscopically visible. Thus angiomatosis may be classified with the systemic tumor-forming malformations of the central nervous system such as neurofibromatosis and tuberous sclerosis.

Bertha Klien.

11. OPTIC NERVE AND TOXIC AMBLYOPIAS

Baurmann, M. **The differential diagnosis between choked disc and papillitis.** Graefe's Arch., 1935, v. 134, p. 189.

The author has repeatedly pointed out that the method of measuring intracranial pressure by observing the pulse in the central vein gives no differential diagnosis between choked disc and papillitis, because an inflammatory edema congests the veins just as in choked disc. Details of a case are cited to illustrate this assertion. H. D. Lamb.

Lauber, H. **Concerning the influence of low blood pressure upon diseases of the optic nerve.** Wien. klin. Woch., 1935, v. 48, Aug. 30, pp. 1079-81.

In low general blood pressure the arterial and venous retinal pressure and the capillary pressure are also low, the retinal circulation is slow, and normal intraocular pressure has an unfavorable influence upon the circulation. In a series of tabetic patients, those with optic atrophy always had low blood pressure. The variations of intraocular pressure were within normal limits, but it was found that the eye with the more advanced atrophy always had the higher

tension. Two ways were found to improve the visual acuity in such patients while avoiding the often unfavorable influence of antiluetic treatment upon such eyes. One was to correct the general hypotony, the other to lower the intraocular tension. The author recommends careful study of the blood pressure and intraocular tension in luetic and metaluetic patients receiving antiluetic treatment. Bertha Klien.

Prati, L. **A case of luetic optic atrophy treated with pyretotherapy.** Riv. Oto-Neuro-Oft., 1935, v. 12, March-April, pp. 288-294.

A luetic man of 47 years whose vision was reduced to 1/20 in the better eye and whose left pupil was larger than the right one, with pupillary reaction absent and left optic atrophy, was submitted to a pyretogenic treatment. Twelve febrile accesses were provoked at three-day intervals and were followed by bismuth and mercury treatment. At the end of eight months the retinal arteries were found larger and vision improved to 15/20 right and 1/20 left. M. Lombardo.

Young, C. A. **Friedreich's ataxia showing transitional symptoms of Marie's disease (familial spinocerebellar ataxia).** Trans. Amer. Ophth Soc., 1934, v. 32, pp. 626-638.

Young reviews the literature and reports two cases of this disease in brothers. In one the optic atrophy developed at the age of five, in the other at the age of twenty years. C. Allen Dickey.

12. VISUAL TRACTS AND CENTERS

Morselli, G. E. **A case of tumor of the left occipital lobe.** Riv. Oto-Neuro-Oft., 1935, March-April, pp. 239-240.

In a man of twenty-one years a gliomatous neoplasm occupying the entire occipital lobe showed the following eye symptoms: both eyes blind, pupils of average size, isocoric, slugglishly reacting to light and convergence; bilateral miosis on forcibly opening the lids; left eyeball deviated outward in the state of rest and its upward movements limited; both eyes nystagmic on lateral movements. M. Lombardo.

Puglisi-Duranti, G. **Ocular manifestations of posterior cervical sympathetic syndrome.** Riv. Oto-Neuro-Oft., 1935, v. 12, July-Aug., pp. 565-570.

A woman of 64 years showed the following eye symptoms among others: fatigue of near vision even with glasses, slight photophobia, lacrimation, myodesopsia, slight hyperemia of the bulbar conjunctiva, and slight corneal hypesthesia. A woman aged 59 years was affected by attacks of corneal ulcer and episcleritis. Both patients showed defects of vision uncorrectable by glasses, and tenderness in the region of the supraorbital nerve. All symptoms recovered after cervical diathermy. (Bibliography.) M. Lombardo.

Vampré, Enjolras. **Reading disturbances of cerebral origin.** Arquivos do Instituto Penido Burnier, 1934, v. 3, Dec., pp. 125-151.

The author describes in detail five cases of alexia or dyslexia from various causes (syphilis, traumatism, circulatory disorders). The hypotheses of Pierre Marie and Déjerine are discussed. Two additional observations relate to vague alterations in the function of reading caused in one case by disturbance of accommodation as a sequel of epidemic encephalitis, and in the other by a posterior cervical syndrome. (10 illustrations.) W. H. Crisp.

13. EYEBALL AND ORBIT

Baurmann, M. **Measurements of the blood pressure in a case of pulsating exophthalmos, which led to a testing of carotid function.** Graefe's Arch., 1935, v. 134, p. 192.

A fifty-year-old patient fell upon the back of his head. Four months later typical pulsating exophthalmos was observed on the left side. At the beginning of the treatment by compression, the open connection between the carotid and venous systems produced pressure of 49 mm. Hg in the left central vein as compared with 21 mm. in the right. Upon manual compression of the carotid (and incidentally of the internal jugular vein), the pressure in the central vein increased to 61 mm. Hg. The dias-

tolic pressure in the central artery of the left eye at first measured 62 mm. Hf., but sank to 56 mm. Hg upon compression of the carotid, so that the arterial pressure was less than the venous. Immediately after compression of the left carotid, as the blood returned into the retinal vessels, bright red arterial blood first appeared in the veins on the papilla and then spread with pulsations into the periphery, while dark venous blood first appeared in the peripheral branches of the arteries and then with pulsations progressed to the papilla. Six weeks after beginning treatment by compression, the pressure in the central vein became normal and all symptoms disappeared. H. D. Lamb.

Bietti, G. **A bilateral malformation of lids, conjunctiva, and cornea not described before.** Boll. d'Ocul., 1934, v. 13, Dec., pp. 1537-1544.

A girl, examined by the writer four days after birth, showed the following bilateral malformations: lids small but of normal conformation, with a very large aperture; the bulbar conjunctiva replaced by a piece of regular skin the central part of which showed a round aperture deep in which was a small xerotic cornea; the eyeballs regularly movable and light perception present in both. The embryonic pathogenesis of this defect is discussed together with its relation to other congenital ocular malformations. (Bibliography, 6 figures.)
M. Lombardo.

Kanda, Kanji. **A case of unilateral anophthalmos with a cyst.** Brit. Jour. Ophth., 1935, v. 19, Sept., p. 512.

A boy aged five years had a slightly abnormal right eye, the cornea being 8 by 6 mm. and the eyeball somewhat smaller than normal. In the left eye the lids and conjunctival culs-de-sac were normal, but in the lower lid was a projection of the skin under which a cystic rudimentary eyeball was hidden.
D. F. Harbridge.

Katz, D., and Ledoux, A. C. **Measurement (roentgenometry) of anteroposterior diameter of the eyeball in situ correlated with micrometer measurement following enucleation.** Amer. Jour. Ophth., 1935, v. 18, Oct., pp. 914-924.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
640 S. Kingshighway, St. Louis

News items should reach the Editor by the twelfth of the month.

Deaths

Dr. Joseph Anthony Stockler, Reading, Pennsylvania, aged 51 years, died September 9th, of heart disease.

Personals

Mr. John W. Lewis, father of Dr. F. Park Lewis of Buffalo, died at his home at the age of 101 years, on October 9th.

Dr. Charles H. May and Dr. Charles A. Perera announce the removal of their offices to 70 East 66th Street, New York City.

Societies

The Philadelphia County Medical Society, Section on Ophthalmology, gave the following program on November 7, 1935: Paralytic strabismus with unusual features, by Dr. James F. Finegan; Abducens paralysis following spinal anesthesia, by Dr. Jacob Reber; Toxic manifestations from eyelash dye, by Dr. Aaron Brav; Tubercular iridocyclitis with keratitis and bilateral cyclitic cataracts, by Dr. Glenn G. Gibson; Cartilage implant for enophthalmos, by Dr. Edmund B. Spaeth.

Dr. C. W. Rutherford, recently of Iowa City, Iowa is now associated with Dr. George S. Row, 906 Hume Mansur Building, Indianapolis, Indiana.

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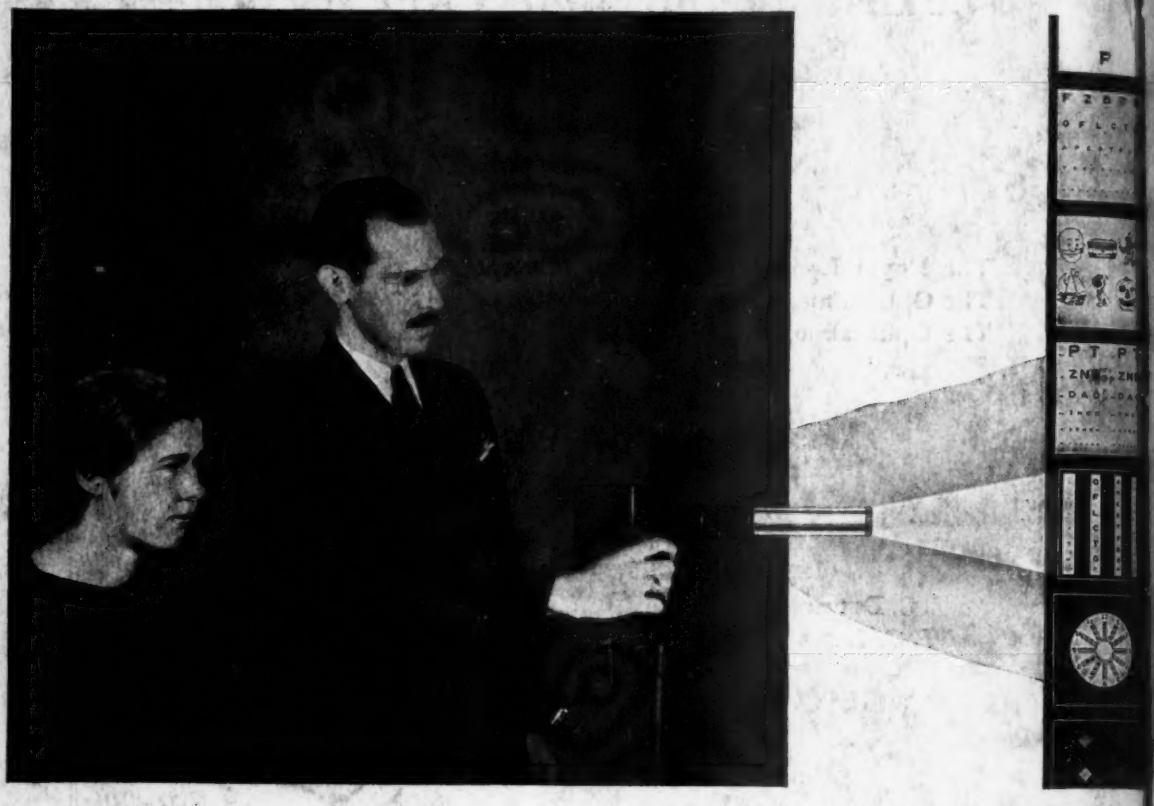

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